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NATIONAL DAM INSPECTION PROGRAM. POTIC RESERVOIR DAM (NY 00307)--ETC(U)
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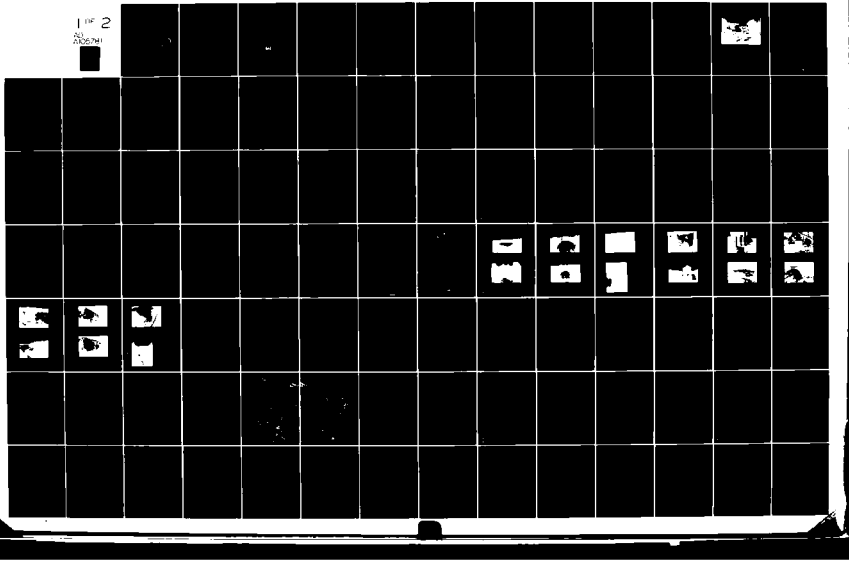

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18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Greene County
Lower Hudson River Basin

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report provides information and analysis on the physical condition of the dam as of the report date. Information and analysis are based on visual inspection of the dam by the performing organization.

Examination of available documents and visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial work.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Structural stability analysis of the spillway section indicates unsatisfactory stability for the 1/2 PMF condition and instability for all other loading conditions, including the normal spring-summer-fall condition and the winter ice load condition.

Therefore, it is recommended that within 6 months after receipt of this report by the Owner, a detailed structural stability analysis be started to better assess stability of the spillway under all loading conditions. The analysis should include appropriate field and laboratory work to determine the actual properties of the rock foundation under the spillway and structural details. Any necessary remedial work should be completed within 18 months after receipt of this report by the Owner. The detailed analysis and the design and construction observation of any remedial work should be done by a qualified, registered professional engineer.

Hydrologic and hydraulic analysis indicates that the dam would not be overtopped by the PMF. The PMF peak outflow due to reservoir routing is about 96% of maximum spillway discharge capacity. Therefore, in accordance with Corps of Engineers' screening criteria for review of spillway adequacy, the spillway is considered "adequate".

LOWER HUDSON RIVER BASIN

TOWN OF COXSACKIE

GREENE COUNTY, NEW YORK

POTIC RESERVOIR DAM

NY 00307

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY

NEW YORK DISTRICT, CORPS OF ENGINEERS

26 FEDERAL PLAZA

NEW YORK, NY 10278

JULY 1981

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I Inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

POTIC RESERVOIR DAM, NY 00307

PHASE I INSPECTION REPORT

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TABLES

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification No.: NY 00307

Name of Dam: Potic Reservoir Dam

State Located: New York

County: Greene

Municipality: Town of Coxsackie

Watershed: Lower Hudson River Basin

Stream: Cob Creek

Date of Inspection: April 9, 1981

ASSESSMENT

Examination of available documents and visual inspection of the dam did not reveal conditions which constitute an immediate hazard to human life or property. However, the dam has some deficiencies which require further investigation and remedial work.

Structural stability analysis of the spillway section indicates unsatisfactory stability for the 1/2 PMF condition and instability for all other loading conditions, including the normal spring-summer-fall condition and the winter ice load condition.

Therefore, it is recommended that within 6 months after receipt of this report by the Owner, a detailed structural stability analysis be started to better assess stability of the spillway under all loading conditions. The analysis should include appropriate field and laboratory work to determine the actual properties of the rock foundation under the spillway and structural details. Any necessary remedial work should be completed within 18 months after receipt of this report by the Owner. The detailed analysis and the design and construction observation of any remedial work should be done by a qualified, registered professional engineer.

Hydrologic and hydraulic analysis indicates that the dam would not be overtopped by the PMF. The PMF peak outflow due to reservoir routing is about 96% of maximum spillway discharge capacity. Therefore, in accordance with Corps of Engineers' screening criteria for review of spillway adequacy, the spillway is considered "adequate".

Within 3 months after receipt of this report by the Owner, the toe of the dam should be exposed by removing the miscellaneous fill that was placed on a portion of the downstream side of the dam.

The following additional investigations should be started within 6 months after receipt of this report by the Owner. The investigations should be performed by a qualified, registered professional engineer.

1) Inspect the downstream side of the dam after the miscellaneous fill has been removed.

2) Measure the piezometric pressure in the embankment downstream of the core as recommended in Section 2.1c.

3) Investigate and monitor seeps along the concrete box diversion conduit, other selected seeps in the vicinity, and seeps that may be uncovered by removal of the miscellaneous fill.

Any remedial work deemed necessary as a result of these investigations should be completed within 18 months after receipt of this report by the Owner. A qualified, registered professional engineer should design and observe the construction of any necessary remedial work.

The following remedial work should be completed by the Owner within 12 months after his receipt of this report. Where engineering assistance is indicated, the Owner should engage a qualified registered professional engineer. Assistance by such an engineer may also be useful for some of the other work.

1) Institute a program to visually inspect - not just casually look at - the dam and its appurtenances at least once a month.

2) Implement plans to uncover and provide easy access to the operating nut of the blowoff valve.

3) Dewater the inside of the concrete box diversion conduit through the dam and have it inspected by an engineer.

4) Repair the deteriorated and undermined downstream end of the left training wall of the spillway discharge channel, as well as other minor problems along the wall, in accordance with design and field observation of the work by an engineer.

5) Grout shut the reservoir level gauge (observation well) in accordance with specifications and field observation of the work by an engineer.

6) Remove trees, brush, and their root systems from the slopes and to a distance of 20 feet downstream from the toe in accordance with specifications and field observation of the work by an engineer. Fill resulting holes with properly selected, compacted fill. Continue to keep these same areas and the crest of the dam clear by cutting, mowing, and cleanup at least annually.

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7) Backfill animal holes on the downstream slope with proper fill.

8) Repair riprap where it has been damaged and where it has been distrubed by removal of trees, brush, and roots, all in accordance with specifications and field observation of the work by an engineer.

9) Repair the uppermost gate stem guide on the downstream gate in the intake structure.

10) Develop and implement effective routine operation and maintenance procedures for the dam and its appurtenances. The sluice gates and blowoff valve should be exercised regularly.

11) Institute a program of comprehensive technical inspection of the dam and its appurtenances by an engineer on a periodic basis of at least once every two years.

12) Develop an emergency action plan outlining action to be taken to minimize the downstream effects of an emergency, together with an effective warning system.

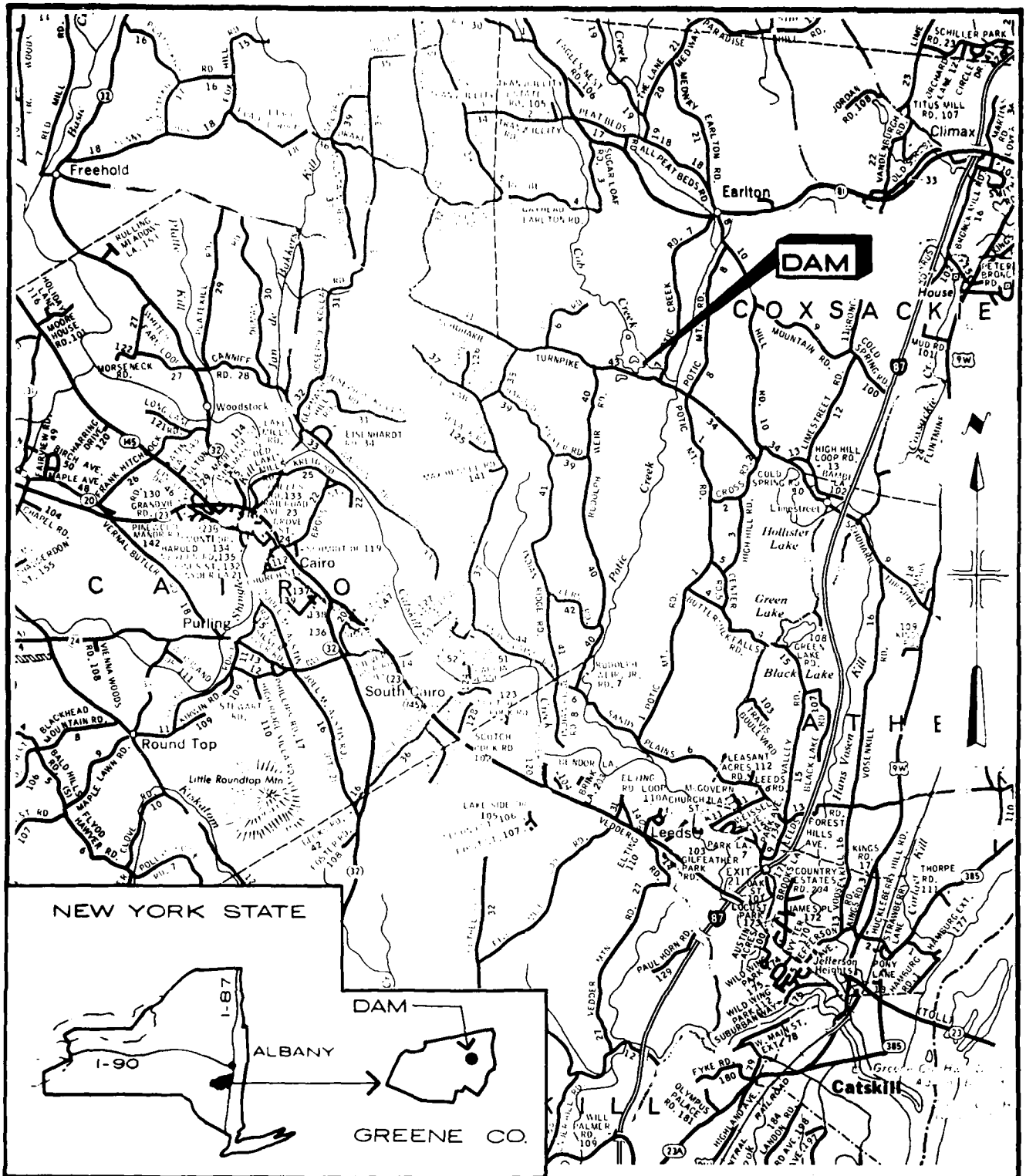
Kenneth J. Male
President
C. T. Male Associates, P.C.
NY PE 25004

Approved by:

Col. W. M. Smith, Jr.
New York District Engineer
Corps of Engineers

Date: 13 AUG 1981

Overview Photo - Potic Reservoir Dam - 4/9/81



SCALE OF MILES

0 1 2 3

BASE MAP: GREENE CO.
HIGHWAY MAP - 1975

POTIC RESERVOIR DAM
VICINITY MAP

TOWN OF COXSACKIE	GREENE CO., NY
SCALE: 1" = 1.5 MI. APPROX	DATE: JANUARY 1981

C.T. MALE ASSOCIATES, P.C.
3000 TROY ROAD, SCHENECTADY, N.Y. 12309
PROFESSIONAL ENGINEERS LAND SURVEYORS LAND PLANNING CONSULTANTS

PROJECT NO. 58.01.009/80.849

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NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

NAME OF DAM: POTIC RESERVOIR DAM, ID NO. NY 00307

SECTION 1

PROJECT INFORMATION

1.1 GENERAL

a. Authority

The National Dam Inspection Act, Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New York District of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within New York State. C. T. Male Associates, P.C., has been retained by the New York District to inspect and report on selected dams in the State of New York. Authorization and notice to proceed was issued to C. T. Male Associates, P.C., under a letter from Michael A. Jezior, LTC, Corps of Engineers. Contract No. DACW51-81-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection

The purpose of the inspection program is to perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public, and thus permit correction in a timely manner by non-Federal interests.

1.2 DESCRIPTION OF PROJECT

a. Location

The dam is located on Cob Creek about 9 miles north of the Village of Catskill. The dam at its maximum section is at Latitude 42 degrees - 19.9 minutes North, Longitude 73 degrees - 55.0 minutes West.

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Access to the dam is from Rte. 9W to the east, then via the Schoharie Turnpike and Potic Creek Road to the water filter plant, and then via a private gravel and stone road to the dam (see Vicinity Map).

The official name of the dam is Potic Reservoir Dam, and the official name of the impoundment is Potic Reservoir. In older information and mapping for the dam and reservoir the word Potic appears as "Potuck".

b. Description of Dam and Appurtenances

Potic Reservoir Dam is a rolled and compacted earth embankment with a clay core. The shells apparently are glacial till and the core is a "mixture of clay and other suitable material". Both the shells and the core were placed in layers. The dam has an ogee spillway at the right abutment. The brush and tree-covered embankment is about 756 feet long (including the spillway) by about 37 feet high, and has a substantial bend point with its apex upstream at about mid-length. The upstream and downstream slopes are about 2.75H:1V and 2.25H:1V, respectively. The upstream slope of the dam is covered with hand-placed rock riprap within 2 or 3 feet of the top of the dam and there is a rockfill at the downstream toe. The top width of the dam is about 16 feet.

The dam has a clay core about 10 feet wide at the top, with about 1H:3V side slopes, that extends down to the original ground surface. A 3-foot-thick concrete cutoff wall extends from about 1 foot into the bedrock up into the clay core about 2 feet. At the upstream toe of the dam a cofferdam used during the construction is incorporated into the embankment. The cofferdam is about 14 feet high, has a top width of about 12 feet, and has an upstream riprapped slope of 2H:1V.

At the right abutment there is concrete ogee spillway in a bedrock channel. The ogee weir cap averages about 4 feet high, is about 141 feet long, and has a bend point with its apex upstream about 90 feet from its left end. The spillway has 3-foot-high flashboards with pipe supports about every 4.5 feet. It appears that the boards will fail at or below overflow depths of 2 feet. The chute discharge channel for the spillway is partially excavated into rock and slopes downstream at about 14%. When flow depths in the spillway are about 6 feet over the concrete ogee crest (above EL 431) an area of concrete abutment and natural ground to the right of the spillway functions as an "auxiliary" spillway.

To the left of the bend point in the dam at about Sta 3+00 on the upstream side there is a concrete intake structure, with a brick gate house on top, connected to the dam via a concrete service bridge. In the gate house there are two hand crank, bevel gear floor stand controls for the slide gates in the intake. One gate is on the upstream side of the intake and one is on the downstream side.

The outlet pipe is a 36-inch-diameter cast iron pipe, reducing down to a 24-inch pipe after the downstream gate, and is inside the right barrel of a double-barreled concrete box culvert

or conduit (see Appendix G-4). The conduit, each barrel of which is 7-feet square, was originally used to divert flow through the dam during construction. The left barrel has been stop-logged on the upstream end, the right barrel has been sealed with concrete around the pipe at the upstream end, and the downstream ends of both barrels have been sealed with brick masonry. At the downstream end of the conduit there is a tee on the 24-inch outlet pipe to a valved blowoff which is normally closed. Also at the tee the pipe necks down to a 16-inch raw water main which runs from the dam to the filter plant about 1000 feet downstream.

c. Size Classification

In accordance with Recommended Guidelines (Reference 1), Potic Reservoir Dam is classified as "intermediate" in size because the maximum storage capacity at the top of the dam is 1,550 acre-feet (within the 1,000 to 50,000-acre-foot range). The height of the dam is about 37 feet.

d. Hazard Classification

In accordance with Recommended Guidelines (Reference 1), Potic Reservoir Dam is classified as having a "high" hazard potential. This is because it is judged that failure of the dam would significantly increase flows downstream which could cause loss of more than a few human lives and excessive property damage. Downstream development that could be damaged or destroyed by a dam failure includes the Village of Catskill Water Filtration Plant, several residences, and a Town road and bridge, all of which are located about 1000 feet downstream of the dam (vertical drop from the dam to this hazard area is about 40 feet).

e. Ownership

The dam was originally constructed in about 1930 for the present owner:

Village of Catskill
422 Main Street
Catskill, NY 12414

Attention: Joseph Izzo, Village President
(518) 943-3830

f. Operator

Day-to-day operation of the dam is the responsibility of:

Thomas Porto, Superintendent of Public Works
(same address as Owner)
(518) 943-5530

and

Richard "Rip" Clearwater, Water Plant Operator
RD Box 20
Earlton, NY 12058
(518) 945-2666 at his home next to filter plant
(518) 945-1839 at the filter plant

g. Purpose of Dam

The dam was originally constructed to impound water for use as a public water supply for the Village of Catskill. The impoundment is still used for this purpose.

h. Design and Construction History

The dam was constructed in about 1930 for the Village of Catskill. The designer was Hazen and Everett, Civil Engineers, 25 West 43rd. Street, New York, New York, believed now to be known as Hazen and Sawyer, P.C., 360 Lexington Avenue, New York, New York 10017, telephone (212) 986-0033. Data concerning the original design can be found in Appendices F2, F3, and G. The construction contractor for the original construction is not known.

Around 1974 minor concrete patching to the left training wall of the spillway was performed by Mario Ordirizzi, a contractor from Catskill, New York. During the past year a miscellaneous fill composed of boulders, earth and debris has been piled on a portion of the downstream slope.

There is no knowledge or record of other construction, modification, or major repair to the dam. Refer to Section 2 of this report, as well as to the Engineering Data Checklist in Appendix F2, for a complete discussion of the design and construction history. Selected plans and other engineering data are included in Appendices F3 and G.

i. Normal Operating Procedures

The dam site is visited randomly during high water periods and daily during low water periods, by the Operator, mainly for the purpose of measuring water levels in the reservoir. The outlet works are not operated regularly. In 1980 both of the slide gates in the gate house were adjusted and are now operable. The 24-inch gate valve for the blowoff was also made operational in 1980. At the present time the spillway crest is set at EL 428 (3-foot-high flashboards in place) and the downstream slide gate in the control tower is open. The upstream slide gate and the blowoff valve are presently closed, as they are normally.

1.3 PERTINENT DATA

a. Drainage Area (square miles) — 19.60

b. Discharge at Dam Site (cfs)

Spillway (W.S. at top of dam and flashboards failed)	14,800
"Auxiliary" Spillway (W.S. at top of dam)	1,000
Outlet Pipe (average flow to filter plant)	2.3
Blowoff (Off of outlet pipe and normally closed - estimated potential w/W.S. at flashboard crest)	70
Maximum Known Flood (estimated based on 10 inches of water over flashboard crest reported by Operator to have occurred in March 1980)	350

c. Elevation (feet-NGVD)

All elevations are from design drawings of the dam by Hazen and Everett, Civil Engineers, dated April 1930 (included as Appendices G-1 to G-5) and are assumed to be in feet above mean sea level NGVD (National Geodetic Vertical Datum of 1929). Based on the design drawings, the normal flashboard crest pool (3-foot flashboards) is EL 428, whereas the water surface is listed at EL 429 in the Gazetteer of Lakes (Reference 25). USGS mapping shows no elevation on the water surface.

Top of Dam	435
Design High Water (for 10,000 cfs)	432.5 ±
"Auxiliary" Spillway Crest	431 ±
Spillway Crest - with flashboards	428
- without flashboards	425
Entrance Invert of Outlet Pipe and Blowoff	403 ±

d. Reservoir Length (feet) - at flashboard crest — 4100 ±

e. Reservoir Surface Area (acres)

Top of Dam	126 ±
Spillway Crest - with flashboards	79
- without flashboards	70 ±

f. Reservoir Storage (acre-feet)

Top of Dam	1550
Spillway Crest - with flashboards	757
- without flashboards	536

g. Dam

Type - Earth with clay core.
Length - About 756 feet including spillway.
Height - About 37 feet.
Top Width - About 16 feet.

Side Slopes - Upstream - About 2.75H:1V, same as design.
- Downstream - About 2.25H:1V, same as design.
Zoning - Upstream and downstream shells are probably glacial till.
Impervious Core - Clay core consisting of a "mixture of clay and other suitable material", about 10 feet wide on top with about 1H:3V side slopes and extending from about 0.5 of a foot below top of dam down to original ground.
Cutoff - 3-foot-thick concrete wall varying in height and carried from about 2 feet up inside clay core down to about 1 foot into bedrock.
Grout Curtain - None known.

h. Spillway

1) "Service" Spillway
Type - Concrete ogee with 3-foot flashboards.
Length of Weir - 141 feet.
Upstream Channel - Reservoir immediately upstream of ogee crest. Bottom of reservoir upstream averages 5 feet lower than ogee crest.
Downstream Channel - About a 150-foot-long excavated and natural rock channel dropping off steeply further downstream.

2) "Auxiliary" Spillway
Type - Overflow just to the right of the "service spillway", consisting of about 10 feet of concrete wall and about 30 feet of natural ground at the right abutment which is lower than the top of dam.
Length of Weir - About 40 feet.
Upstream Channel - Grassed shore of reservoir tapering up to flatter ground in line with right abutment.
Downstream Channel - Tree-covered ground tapering down to "service" spillway channel downstream of ogee crest.

5235 i. Diversion Conduit
Type - Double barreled reinforced concrete, each barrel 7 feet square.
Length - About 160 feet.
Closure - Left barrel, 6" x 8" oak stop logs, bolted together and caulked, across the upstream end. Right barrel, double 4-foot thick concrete plugs at bottom of control tower with 36-inch outlet pipe through the plugs. Downstream end of both barrels closed with 18-inch-thick brick masonry. Exposed downstream sides of conduit may be brick masonry as well.

Access - Downstream end at toe of dam is bricked up, access hatch in top of downstream end to inside of right barrel, no apparent access to inside of left barrel, upstream ends of both barrels are underwater.
Regulating Facilities - (see Outlet Works)

j. Outlet Works

1) Outlet Pipe
Size - 36-inch diameter necking to 24 inches.
Description - Cast iron pipe inside right barrel of diversion conduit, 36-inch diameter under gate house necking to 24 inches inside remainder of conduit. Just after exiting from downstream end of conduit, pipe necks to 16-inch diameter raw water main to filter plant.
Control - Two 36-inch sluice gates under gate house with hand crank, bevel gear floor stands in gate house, plus stop logs on upstream side of gate house. The upstream sluice gate is a low level intake and is normally closed, whereas the downstream gate is normally open. Flow to filter plant controlled by a float-actuated valve at filter plant.

2) Blowoff
Size - 24-inch diameter.
Description - Short cast iron pipe branching from tee in outlet pipe just downstream of d/s end of diversion conduit. Can act as reservoir drain.
Control - Buried 24-inch valve next to tee branch. Also subject to same control as outlet pipe.

SECTION 2

ENGINEERING DATA

2.1 DESIGN DATA

a. Geology

There was no geologic information available in the design data for this dam. The following information was obtained from current geologic maps and publications for this region (References 28, 29, and 30) as well as from the site visit.

Potic Reservoir Dam is located within the Catskill section of the Appalachian Plateaus Province. Bedrock in the vicinity consists of shale and sandstone which is Middle Devonian (approximately 370 million years old).

The dam is at the northeastern fringe of relatively flat sedimentary sequences comprising basin rocks of the Catskill Mountains.

The bedrock that is exposed in the spillway discharge channel is shale or sandstone. The bedding planes strike N 45° W and dip 10° NE.

b. Subsurface Investigations

According to the plans and specifications for construction (April 1930, see Appendices F3 and G), one test pit and ten borings were made along the approximate line of the concrete cutoff wall, which is approximately under the centerline of the dam. In the application for construction (May 5, 1930, see Appendix F3-39) the overburden was described as "pervious but water bearing only in bed of stream. Fairly uniform mixture of loam, sand, gravel & boulders." The depth of the overburden ranges from 7 to 17 feet along the line of borings.

Based on visual observations on the day of inspection, the overburden in this area is glacial till. It probably contains outwash deposits near the old stream bed which passed under the dam at about Sta 2+00.

In the drawings (April 1930, see Appendix G-1) a large zone in the vicinity of the dam was specified as a borrow area for the embankment. A smaller 4-acre area about 600 feet upstream from the dam, beside the old creek bed, was shown as the source of clay for the core.

c. Dam and Appurtenances

The dam was designed in 1930 by Hazen and Everett, Civil Engineers, 25 West 43rd Street, New York, New York, believed now to be known as Hazen and Sawyer, P.C., 360 Lexington Avenue, New York, New York 10017, telephone (212) 986-0033.

99 The dam and reservoir were part of the design for the entire Village of Catskill water supply system, which also included a water filtration plant and water transmission and distribution mains. The Owner has a complete set of prints of the design/construction drawings. Sheets pertinent to the dam are reproduced at reduced scale in Appendix G. Included in Appendix F3 are construction specifications for the dam as well as the application for its construction.

The specifications (April 1930, see Appendix F3-1) for the clay core are worded as follows:

> "an impervious core shall be formed of a mixture of clay and other suitable material placed in alternate layers and thoroughly mixed together and compacted by the action of the grooved roller"

This description does not make it clear whether (a) clay and other materials were mixed before spreading or (b) the clay layers were alternated with layers of other materials, such that the two layers were squeezed together by the roller.

For case (a), the core can be assumed impervious. For case (b), one could expect that some of the layers might be more pervious than others. The latter is an undesirable situation because the piezometric surface on the downstream side of the core could be high due to the layering. As a check it is advisable to measure the piezometric pressure downstream from the core.

20 2.2 CONSTRUCTION HISTORY

a. Initial Construction

The dam was constructed in about 1930. The original contractor for the dam is unknown. No records concerning the actual construction of the dam and appurtenances are known to exist. The design/construction specifications (see Appendix F3-1) do describe a diversion scheme and construction sequence for the dam (see Appendices F3-22 and F3-23). According to the specifications a diversion conduit (the presently-plugged double-barrelled conduit) was to be built first. Then a substantial cofferdam was to be built across the existing creek channel, diverting the flow through the diversion conduit. The dam and control tower were then to be constructed. The final steps of

the construction sequence included installing the upstream gate in the right barrel of the diversion conduit, plugging the upstream end of the left barrel with oak stop logs, and installing the downstream slide gate and outlet pipe in the right barrel.

A brief review of the construction history, as can be determined from the design/construction drawings and specifications, can be found on Appendix F2-2.

b. Modifications, Repairs, and Maintenance

Around 1974 minor concrete patching of the left training wall of the spillway was performed by Mario Ordirizzi, a contractor from Catskill, New York. During the past year a miscellaneous fill composed of boulders, earth, and debris has been piled on a portion of the downstream slope.

There is no knowledge or record of other construction, modification, or major repair of the dam.

c. Pending Remedial Work

The Operator plans to dig up the valve operating nut for the 24-inch blowoff sometime this year and install a valve box over it so that it can be found and operated more easily in the future.

2.3 OPERATION RECORD

a. Inspections

There is no known record of inspection of the dam by the Owner.

A water supply report on the Village of Catskill water system was written by the State Health Department in 1971. This report mentions that the dam and spillway need maintenance. The growth of trees on the dam and the need for their removal was noted. The report also suggested that concrete spalling off the spillway should be repaired. The relevant portion of this report has been included as Appendices F3-47 to F3-49.

198 A New York State Department of Environmental Conservation (NYS-DEC) Inspection Report for the dam dated September 14, 1972, was found and has been included as Appendix F3-50. This inspection report indicates the growth of trees on both the upstream and downstream slopes of the dam. In the report the deterioration of various concrete surfaces as well as of the toe of the ogee spillway is noted. The report also indicates that some routine maintenance of the dam does occur.

b. Performance Observations

Other than the observations on seepage and erosion made in the various inspection reports (see Appendix F3), there are no other known records of performance observations.

There is a reservoir water level gauge (observation well) in the dam near the left end of the spillway (see Section 3.1b). The well is a 12-inch cast iron pipe with a 20-foot-long, 2-inch brass pipe off of the bottom through the upstream embankment. The Operator has never used the well for recording water levels. Also, there is a float-cable-weight water level gauge system in the gate house which is not used (the staff board and weight are in the background of Photo A-6A).

c. Water Levels and Discharges

The water level is measured directly on the spillway on a random basis by the Operator during periods of high flow. When the water level is low (below flashboards) the Operator records the water level daily. These level readings are recorded on the daily worksheets for the filter plant. The period of record is unknown.

The Operator also has a rain gauge at the filter plant and records the rainfall daily (see Appendix F2-3). Rainfall records date from around 1965 to the present.

In the years 1958 to 1961 capacity surveys of the reservoir were made by Benjamin L. Smith and Associates (see Appendix F3-43 to F3-46 and G-8). A storage capacity curve for the reservoir done by the same firm appears as Appendix G-7.

d. Past Floods and Previous Failures

There are no known records of past floods at or previous failures of the dam. It has been reported that all of the flashboards failed at one time but the exact cause is unknown. The Operator indicated that the highest water level in his 15 years of service was about 10 inches above the flashboards in March 1980. At that time over 7 inches of rain in 24 hours was recorded at the filter plant gauge.

2.4 EVALUATION

a. Availability

As listed on Appendix F1, various engineering data and records are available in the files of the Owner, the Owner's present consulting engineer, the Dam Safety Section of the NYS-DEC, and the Northern Region Office of the NYS Department of Health. This data was reviewed, and copies of the records significant to the

dam are included in chronological order in Appendices F3 and G. Appendix F2, Checklist for General Engineering Data and Interview with Dam Owner, also contains pertinent engineering information.

b. Adequacy

Available data consisted of the design/construction drawings, construction specifications, 2 inspection reports, various correspondence and data concerning reservoir capacity, and comments by the Operator of the dam. Such data as design calculations, record drawings, complete data on foundation and embankment soils, and operation and performance data were not available. The lack of such in-depth engineering data does not permit a comprehensive review. Therefore, the available data was not adequate by itself to permit an assessment of the dam.

c. Validity

Based on field observation and checking, a majority of the data appears to be valid. One major discrepancy noted was that the drawings show the spillway to be 140 feet long without a bend point, while field observations show that the spillway is about 141 feet long with a bend point.

The drawings show flashboard sockets 3 feet deep, while the Operator indicates that they are 4 feet deep. The drawings also show flashboard supports as 2-inch extra strong pipe when in actuality the supports are 2-inch pipe, with 1.5-inch pipe inside, all standard galvanized.

In the field inspection it was noted that there were no stop logs across the intake to the gate house as shown on the drawing, Appendix G-4. Also, the November 1971 Water Supply Report (Appendix F3-47) describes a 3-level water intake and its operation which does not seem to match the configuration of the intake shown on the drawing, Appendix G-4.

The upstream stone paving stops about 2 or 3 feet below the crest elevation (see Photo A-4B and A-5A). On the drawings (see Appendices G-2 to G-4) the paving is shown to cover the entire upstream slope.

The right vertical wall of the diversion conduit, where it is exposed on the downstream side, is made of brick both inside and outside. The drawings indicate that this wall was planned to be concrete.

SECTION 3

VISUAL INSPECTION

3.1 FINDINGS

a. General

Potic Reservoir Dam was inspected on April 9, 1981. The inspection party (see Appendix B-1) was accompanied by Mr. Richard "Rip" Clearwater, Water Plant Operator, who represented the Owner. Also present was Mr. Larry Gambarato, representing the Owner's present consulting engineer. The weather was cool and cloudy, with rain occurring later in the afternoon. The water surface was at EL 428.2, or about 2 inches over the flashboard crest at the time of the inspection. The Visual Inpsection Checklist is included as Appendix B, while selected photos taken during the inspection are included in Appendix A and as the Overview Photo at the beginning of this report. Appendix A-1 is a photo index map.

b. Dam

There is no evidence of sloughs or slides of the embankment.

Trees and Brush - Trees and brush cover the downstream slope of the dam (see Photo A-4A). A few trees are as large as 10-inches in diameter, but most are 4 to 6 inches in size. It appears that the downstream slope had been kept trimmed until 10-15 years ago, after which the trees were allowed to grow at will.

A line of brush and small trees grows at the normal pool level and just above the top of the riprap (see Photo A-4B).

Fill on Downstream Slope - A miscellaneous fill composed of boulders, earth, and debris has been piled during the past year onto the downstream slope in the old stream channel, where the dam is highest (see Photo A-2B). An access road to the crest, which runs up the downstream slope, was constructed of fill at about Sta 1+50.

This fill, most of which was discarded from a nearby construction project, covers the zone of the dam where the overburden was water bearing, according to the records. Any seeps that are penetrating the embankment or the concrete cutoff wall in this vicinity have been hidden by the fill. Based on the volume of flow in the stream downstream from the fill, it appears that seepage may be occurring beneath the fill.

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Seepage - A clear seep of 5 to 10 gpm was observed on the right side of the downstream end of the diversion conduit at the toe of the dam. It seems likely that this seep is passing alongside the conduit all the way through the dam. There were no special provisions made in the design to cut off or control this possible flow of water.

Many seeps were observed between 50 and 180 feet downstream from the toe between Sta 2+80 and Sta 6+50. These seeps total 15 gpm or greater and seem to be carrying no fines (see checklist, Appendix B). They appear to be emerging from the bedrock where bedding planes exit downstream.

Any seeps that may exist in the zone of the former stream bed on the left side of the dam have been covered by the recent miscellaneous fill, as described above.

Reservoir Gauge - The design drawings for the dam show a 12-inch-diameter vertical cast-iron-pipe reservoir level gauge that is located about 9 feet to the left of the left spillway training wall and about 6 feet downstream from the upstream crestline. The bottom of this pipe is apparently connected to a horizontal brass pipe that runs upstream to the reservoir at EL 421 (about 4 feet below spillway crest elevation). On the day of inspection the water level in the gauge was the same as the reservoir level, as it should be.

In cross section the drawings show that this reservoir gauge penetrates about 15 feet down into the clay core of the dam on the upstream side of the centerline. Any movement or corrosion that might cause the joint between the brass and cast iron pipe to break would enable the full reservoir pressure to reach well into the core at this location. It is advisable to grout this entire reservoir gauge with a slightly-expanding grout. Since the reservoir level can be read at the gate house, and since the reservoir gauge is not used, no operational difficulties would ensue.

Stone Paving - The stone paving on the upstream slope has been heaved up above the former slope surface at several locations. The greatest heave occurs just to the right of the gate house about 4 feet above the spillway crest elevation (see Photo A-5A). It appears that this heave was caused by horizontal pressure of ice on the reservoir. It may also be caused by frost action. These zones should be maintained to avoid further deterioration.

Animal Holes - Two small animal holes were found about 7 feet below the crest on the downstream slope at Sta 3+00 and Sta 4+45. These holes should be filled.

c. Appurtenant Structures

1) Intake Structure and Control Tower

The intake structure and control tower are one in the same concrete structure located upstream of the dam just to the left of the bend point. The portion of the control tower above water, along with the gate house located on top, are shown in Photo A-5B.

The exposed concrete of the control tower appears to be in good condition with only some minor cracking. A portion of the steel trash racks on the top portion of the intake structure were visible. They had some rust, but were generally in good condition. The remainder of the intake structure and control tower was submerged.

The gate house for the dam is a brick structure with a wood-framed, slate-shingled roof. The gate house was in good condition. The wooden parts of the gate house, however, could use a coat of paint. Inside the gate house there are 2 hand crank, bevel gear floor stand controls for the 2 slide gates at the bottom of the control tower (see Photo A-6A). Both of these control mechanisms were well lubricated, operable, and in good condition. The upstream gate was closed and the downstream gate was open at the time of inspection. The uppermost gate stem guide for the downstream gate is broken and detached from the stem.

2) Service Bridge

The service bridge is a concrete walkway with steel pipe railings spanning from the gate house to the top of dam. The bridge deck and its supports are in good condition. The railings, however, are loose and are rusting in spots.

3) Outlet Works

The only visible portions of the outlet works are the end of the diversion conduit, a double-barreled concrete conduit now sealed with brick at its downstream end (see Photo A-6B), and the 24-inch blowoff pipe with its headwall (see Photo A-7A). The downstream end and exposed sides of the concrete diversion conduit were sealed with brick which is now breaking apart and deteriorating. On top of the end of the right barrel of the conduit there is a square access hatch into the chamber which was opened during the inspection. This chamber was filled with water to within 2 feet of the top, making the inspection of the 24-inch outlet pipe (raw water main) in the chamber, as well as the chamber itself, impossible. The source of this water is unknown and is cause for concern.

The 24-inch blowoff pipe was in good condition. The concrete headwall at the end of the blowoff pipe had a crack from its top down to the top of the pipe. The valve to the blowoff was last operated in 1980 and presently the operating nut is buried.

There is also an automatic float-actuated valve on the downstream end of the raw water main at the water treatment plant. It operates regularly, controlling flow from the reservoir to the water treatment plant.

4) Spillway

The spillway is near the right abutment of the dam (see Photos A-7B and A-8B). It consists of a concrete ogee weir cap with 3-foot-high wooden flashboards, a concrete left training wall, and a short concrete wall at the right abutment with natural rock forming the right boundary of the natural rock spillway discharge channel.

The ogee weir cap is in fairly good condition (see Photos A-7B, A-8A, and A-8B). The toe of the ogee section is broken off in spots and there is some deterioration of the concrete at the construction joints. There is some leakage through the flashboards and some of their support pipes are bent.

The dip of the bedrock below the spillway is about 10 degrees in the downstream direction, which means that the thrust of the spillway section tends to slide it downhill along bedding planes.

The left training wall of the spillway is in fair condition (see Photo A-9A). There is severe scaling along the top of the wall. There is spalling at the joint where the wall changes slope (see Photo A-9B) and at the next joint 20 feet downstream. There is severe scaling and undermining of the wall at its downstream end (see Photo A-10A). The left training wall also has efflorescence and staining along its entire length.

The right abutment area of the dam also can act as an emergency overflow section or "auxiliary" spillway when flow elevations exceed about EL 431 (see Photo A-7B). This area is in good condition with some tree growth downstream of the axis of the dam.

The spillway discharge channel is in natural and excavated rock (see Photo A-10B) and drops off down to the existing stream channel. The discharge channel is wide and clear with some sporatic tree growth above the junction with the existing stream channel.

d. Reservoir Area

The reservoir area is covered with evergreens and hardwoods and has moderate slopes. There were no observations made

that might indicate excessive erosion or slide potential in the reservoir area.

e. Downstream Channel

The downstream channel is a continuation of the natural rock spillway discharge channel where it flows into the existing stream, Cob Creek (see Photo A-10B). Cob Creek is a natural, rocky channel with heavy tree growth along its banks.

3.2 EVALUATION

The trees and brush and their root systems on the downstream and upstream slopes should be removed.

The miscellaneous fill on the downstream slope at the highest point of the dam obscures the condition of the dam in this critical zone. An investigation should be made to determine how to treat this zone of the dam.

Selected seeps that exit downstream from the toe, and the seep along the right of the diversion conduit should be monitored and the data evaluated periodically.

Repairs should be made to the riprap where it has heaved and the animal holes, although minor, should be filled.

The reservoir gauge near the spillway should be grouted with a slightly-expanding grout or other impervious material to avoid the possibility of the reservoir pressure acting within the core from this cause.

The diversion conduit should be dewatered and inspected. The only permanent plug for the left barrel of the diversion conduit appears to be 6-inch by 8-inch oak stop logs, bolted together and caulked, across the upstream end of the conduit barrel. The condition of this plug should also be investigated. Failure of the stop logs would probably not endanger the dam but would obviously drain the reservoir thereby depleting the water supply.

The operating nut for the gate valve on the blowoff pipe should be dug up and made readily accessible at all times.

The undermined area at the end of the left spillway training wall should be repaired and the deteriorated concrete along other areas of the wall should be patched.

The uppermost gate stem guide for the downstream gate in the intake structure should be repaired.

SECTION 4

OPERATION AND MAINTENANCE PROCEDURES

4.1 OPERATION PROCEDURES

There are no written operation procedures for the dam.

Potic Reservoir is used as the public water supply for the Village of Catskill. Normally the downstream outlet gate in the gate house remains open and there are three-foot-high flashboards on the spillway crest. The upstream gate in the gate house and the valve on the 24-inch blowoff are normally closed. Outflow from the reservoir through the outlet pipe is controlled by an automatic float-actuated valve at the filter plant. The average daily outflow to the filter plant is 1.5 mgd (about 2.3 cfs).

At the time of inspection the reservoir level was about 2 inches higher than the flashboard crest, with outflow over the spillway flashboards estimated to be 30 cfs.

4.2 MAINTENANCE OF DAM AND OPERATING FACILITIES

There are no written maintenance procedures for the dam.

The dam site is visited randomly during high water periods and daily during low water periods, by the Operator, mainly for the purpose of measuring water levels in the reservoir. Brush was last cut off a portion of the dam in about 1975 and the dam crest was last mowed in 1979. Every spring floating debris is cleaned off of the flashboards and large debris is removed as required at other times. Whenever any section of flashboards fail, all boards and any damaged pipe supports are replaced.

According to the Operator there is no regular or periodic operation of any of the gates or valves at the dam. In 1980 both gates in the gate house were adjusted and their operation was tested. Also in 1980 the 24-inch gate valve on the blowoff pipe was operated as a test. The valve box for this valve is presently removed and the valve operating nut is buried.

4.3 EMERGENCY ACTION PLAN AND WARNING SYSTEM

There is no written emergency action plan and warning system for the dam.

4.4 EVALUATION

Maintenance of the dam is unsatisfactory even though there have been repairs and some regular maintenance to the dam over the

past years. Some maintenance items, such as the removal of brush and tree growth on the dam slopes, have been neglected. The recent operation (1980) of the gates and blowoff valve at the dam was needed and the regular exercising of these appurtenances should be continued. More effective operation and maintenance procedures need to be developed and implemented by the Owner in order to avoid deterioration of the dam.

The Owner should develop an emergency action plan outlining action to be taken to minimize the downstream effects of an emergency, together with an effective warning system.

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SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 DRAINAGE AREA CHARACTERISTICS

Potic Reservoir Dam and Potic Reservoir are located on Cob Creek in eastern New York. About 2000 feet downstream of the dam Cob Creek joins Potic Creek. Potic Creek drains south to Catskill Creek. Catskill Creek flows to the east and discharges into the Hudson River.

The total drainage area at the dam is about 19.60 square miles, of which about 0.132 square miles (84.29 acres), or less than one percent, is actual reservoir surface (including about 5 acres of islands) at the spillway crest with flashboards (see Appendices C-5 and C-6). The dam is located near the Hudson River Valley where the topography is characterized by fairly flat slopes of from 1% to 10%. Elevations in the drainage area vary from EL 425 to EL 1110.

5.2 ANALYSIS CRITERIA

The U.S. Army Corps of Engineers Hydrologic Engineering Center's Program HEC-1 DB (Reference 3) was used to develop the test flood hydrology and perform the reservoir routing.

The purpose of this analysis was to evaluate the dam and spillway with respect to their surcharge storage and spillway capacity. Accordingly, it was assumed that the water surface was at the spillway crest with flashboards in place (normal condition) at the start of the flood routing. In addition, the outlet pipe, normally open, was assumed closed because of its small discharge (average draft through pipe is only 2.3 cfs).

A constant base flow of 2 cfs per square mile was chosen to represent average conditions in the drainage area and was inputted into the program for all subareas.

The index PMP (probable maximum precipitation) inputted to the HEC-1 DB program was 20 inches for a 24-hour duration all-season storm over a 200-square-mile basin, according to HMR 33 (Reference 4). Maximum 6-hour, 12-hour, 24-hour, and 48-hour precipitation for the actual size of the drainage area (same for 10 square miles or less) were inputted to the program as percentages of the index PMP in accordance with HMR 33. A storm reduction coefficient was then applied internally by the program in order to transpose or center the storm over the actual total drainage area. Thus, the corrected 48-hour PMP for the actual total drainage area became 22.0 inches. All rainfall was distributed using the Standard Project Storm arrangement embedded in the program.

Appendix C-10 summarizes the subarea, loss rate, and unit hydrograph data inputted to the program. Only two subareas were used. Subarea 1 consists of all the drainage area around the reservoir, and Subarea 2 consists of just the reservoir surface (including the negligible amount of island area). For the land in Subarea 1, loss rates were assumed to be 1.0 inch initially and a constant 0.1 inch per hour thereafter. Snyder unit hydrograph parameters were chosen from the 1977 Lower Hudson River Basin Flood Routing Model (Reference 20). A conservative standard lag time lag was computed. The program uses the inputted lag time and Snyder peaking coefficient to solve by iteration for approximate Clark coefficients which are then used to calculate the runoff hydrograph.

For the reservoir surface making up Subarea 2, loss rates were set to zero so that rainfall would equal rainfall excess, or runoff. Assuming no delay in the rainfall/runoff response, a constant unit hydrograph for a rainfall duration equal to the HEC-1 DB calculation interval was developed per Appendix C-10 and inputted to the program.

The floods selected for analysis were the PMF (probable maximum flood) and 1/2 PMF. Floods as ratios of the PMF (e.g., 1/2 PMF) were taken as ratios of runoff, not of precipitation. Peak inflow for the PMF is about 15,400 cfs or 786 csm (cfs per square mile). Peak outflow is reduced slightly by reservoir routing to about 15,200 cfs (776 csm). For 1/2 PMF the peak inflow is about 7,700 cfs (393 csm) and the routed peak outflow is about 7,500 cfs (383 csm).

5.3 RESERVOIR CAPACITY

Storage capacity data for the reservoir below the spillway crest with flashboards, EL 428, was obtained from a storage capacity curve of the reservoir prepared by Benjamin L. Smith and Associates (see Appendix G-7). Design/construction mapping (see Appendix C-1) was used to obtain area measurements inside contour elevations above the spillway crest and the capacity of the reservoir was computed for these areas by the method of conic sections. A hand tabulation of the reservoir volumes inputted to the program is on Appendix C-7.

At the spillway crest without flashboards, EL 425, the reservoir has a capacity of 536 acre-feet. At the spillway crest with flashboards, EL 428, the reservoir has a capacity of 757 acre-feet. At the top of dam, EL 435, the reservoir has a capacity of 1,550 acre-feet. Surcharge storage between the spillway crest with flashboards and the top of dam amounts to 793 acre-feet, or about 0.8 of an inch of runoff from the total 19.60-square-mile drainage area. Therefore, the reservoir has little capacity to attenuate peak inflow.

5.4 SPILLWAY CAPACITY

The dam has a 141-foot-long concrete ogee spillway with 3-foot-high flashboards and a 40-foot overflow "auxiliary" spillway just to the right of the ogee spillway. The top of dam is about 7 feet higher than the flashboard crest and about 4 feet higher than the "auxiliary" spillway, which consists of a concrete wall and natural ground at the right abutment which act as a spillway for high reservoir outflows.

The discharge capacity for the spillway with flashboards was computed assuming critical flow over a sharp-crested weir. For modeling purposes, the flashboards were assumed to fail when the water surface reached EL 430 (an overflow depth of 2 feet). Our rough calculations indicate that flashboard failure should occur when the water surface is at or below EL 430. The spillway discharge computations are presented on Appendix C-8. With water 10 feet over the spillway crest (i.e., flashboards failed, water level at top of dam) the spillway discharges about 14,800 cfs.

The discharge capacity for the "auxiliary" spillway was computed assuming critical flow over an ideal broad-crested weir. The "auxiliary" spillway discharge computations are also presented on Appendix C-8. With water 4 feet over the "auxiliary" spillway crest (i.e., water level at top of dam) the "auxiliary" spillway discharges about 1,000 cfs.

For the spillway crest starting at EL 428 (before flashboard failure), the "auxiliary" spillway crest at EL 431, and the top of dam at EL 435, the total discharge computations are summarized on Appendix C-9. Total discharge from the dam is the sum of the discharges from the spillway and "auxiliary" spillway, plus flow over the dam for the overtopping condition. As discussed previously in Section 5.2, the capacity of the outlet pipe was neglected due to its small discharge. The sum of the hand-computed discharges for the spillway and "auxiliary" spillway were inputted directly to the HEC-1 DB program.

With the reservoir level at the top of dam, EL 435, the total discharge from the dam is about 15,800 cfs. This is due to both the spillway and "auxiliary" spillway with flashboards failed. The 1930 application for construction (see Appendix F3-40) indicates that the spillway was designed to safely discharge 10,000 cfs. This would correspond to a pool elevation of about 7.5 feet above the spillway crest, or about EL 432.5.

If the flashboards do not fail, total discharge capacity at the top of dam is about 9,700 cfs (8,700 cfs spillway plus 1,000 cfs "auxiliary" spillway).

5.5 FLOODS OF RECORD

As noted in Section 2.3d, there are no known records of past flood discharges at the dam. It has been reported that all of the flashboards failed at one time but the exact cause is unknown. The Operator indicated that the highest water level in his 15 years of service was about 10 inches above the flashboards in March 1980. Using the spillway capacity data developed in Section 5.4, the flow is estimated to have been about 350 cfs (18 csm), or only about 2% of the PMF peak outflow predicted.

5.6 OVERTOPPING POTENTIAL

The results of the overtopping analysis using the HEC-1 DB program are summarized in Table 5.1. The overtopping analysis computer input and output for the PMF and 1/2 PMF are included starting on Appendix C-11.

As noted from Table 5.1, the PMF does not overtop the dam but results in minimum freeboard of about 0.3 of a foot. 1/2 PMF results in minimum freeboard of about 3.7 feet. Peak inflows are 15,400 cfs for the PMF and 7,700 cfs for 1/2 PMF. Peak outflows are reduced very little by reservoir routing to 15,200 cfs for the PMF and 7,500 cfs for 1/2 PMF, and both occur about 47 hours after the start of the 48-hour storm. The peak portion of the inflow and outflow hydrographs for the PMF and 1/2 PMF are shown by the computer plots on Appendices C-17 and C-18.

It should be noted that Town Highway 43, the Schoharie Turnpike, crosses the southern end of the reservoir on an embankment through which the reservoir is conveyed via a culvert (see Vicinity Map, Topo Map Appendix G-8, and H & H Checklist Appendix C-4). Since the low point of the road embankment is estimated at EL 432, the PMF pool would flood the road by about 2.7 feet, while the 1/2 PMF pool would leave about 0.7 of a foot of freeboard.

Potic Reservoir Dam was also modeled to see what would happen if the spillway flashboards did not fail. For this case the total spillway capacity, due to the spillway (without flashboards failing) and the "auxiliary" spillway is about 9,700 cfs. The PMF results in a peak outflow of 15,300 cfs and the dam is overtopped by about 1.3 feet. 1/2 PMF results in a peak outflow of 7,500 cfs and the dam is not overtopped, but is left with minimum freeboard of about 1.0 foot. The computer input and output are not included in this report, but the results are summarized by footnote (e) on Table 5.1.

5.7 EVALUATION

With the reasonable assumption that the flashboards in the spillway would fail at overflow depths greater than 2 feet, the dam would not be overtopped by the PMF. The PMF peak outflow due

TABLE 5.1

POTIC RESERVOIR DAM

OVERTOPPING ANALYSIS

CONDITIONS - Total Drainage Area = 19.60 square miles
Start Routing at Flashboard Crest EL 428
Top of Dam EL 435
Total Project Discharge Capacity at Top of Dam = 15,800 cfs ± due to Spillway (Flashboards fail at W.S. EL 430) and to "Auxiliary"Spillway. Outlet works assumed closed.
Some values rounded from computed results.

	PMF	1/2 PMF [a]
INFLOW		
48 -hour Rainfall (inches)	22.0	12.8 [b]
48 -hour Rainfall Excess (inches) [c]	18.4	9.2 [d]
Peak Inflow (cfs)	15,400	7,700
Peak Inflow (csm)	786	393
OUTFLOW		
Peak Outflow (cfs)	15,200	7,500
Peak Outflow (csm)	776	383
Time to Peak Outflow (hours)	46.5	46.7
Maximum Storage (acre-feet)	1,518	1,094
Max. W.S. Elevation (feet-NGVD)	434.7 [e]	431.3 [e]
Minimum Freeboard (feet)	0.3	3.7
Maximum Depth over Dam (feet)	not overtopped	not overtopped
Duration of Overtopping (hours)	n/a	n/a

(a) One-half of PMF *total runoff, including base flow*. For PMF base flow = 2 cfs per square mile = 39 cfs ± .
(b) Approximation assuming total losses are the same as for the PMF.
(c) Rainfall Excess = Rainfall for the Reservoir Surface. For the rest of the drainage area, losses are assumed to be 1.0 inch initially and 0.1 inch per hour thereafter.
(d) Equal to one-half of PMF value.
(e) *If flashboards do not fail, total discharge capacity at top of dam = 9,700 cfs ±; for PMF,* peak outflow = 15,300 cfs and dam overtopped by 1.3 feet; for 1/2 PMF, peak outflow = 7,500 cfs and minimum freeboard = 1.0 foot.

to reservoir routing is about 96% of maximum spillway discharge capacity. Therefore, in accordance with Corps of Engineers' screening criteria for review of spillway adequacy, the spillway is considered "adequate".

SECTION 6

STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations

None of the visual observations indicated present concern about the stability of the embankment. Certain items that should be investigated or repaired to prevent future deterioration were discussed in Section 3.1.

b. Design and Construction Data

The design data show a reservoir gauge in the core near the left spillway training wall, see Section 3.1b. This gauge should be grouted with impervious material to ensure that full reservoir pressure cannot reach the interior of the core at this location.

There are no details provided in the drawings to ensure that any flow along the outside of the diversion conduit is safely intercepted. The seep along the conduit is flowing clear at present.

c. Operating Records

No operating records were found or operational problems reported which would influence the stability of the structure.

d. Post-Construction Changes

No post-construction changes are known which would affect the stability of the structure.

e. Seismic Stability

This dam is in Seismic Zone 1. According to Recommended Guidelines (Reference 1) a seismic stability analysis is not required.

6.2 STABILITY ANALYSIS

The concrete ogee spillway is a low gravity structure about 5 feet high by about 141 feet long. An independent structural stability analysis was performed on a typical section chosen just to the left of the bend point in the spillway, about 90 feet from its left end. The cross section geometry is based on the design/construction drawings (see Appendix G-3) and on visual observation (see Photos A-7B through A-8A). The following loading cases were analyzed:

Case 1 - Normal pool at flashboard crest 3 feet above spillway crest, full headwater uplift, no tailwater, no silt load because the spillway is not at the deepest part of the reservoir and is a low section.

Case 2 - Pool at spillway crest (no flashboards), ice load of 5 kips per linear foot of spillway for ice 1.0 foot thick, full headwater uplift, no tailwater, no silt. The flashboard support pipes would first fail under an ice load much less than this, which would then lower the pool and allow ice to reform against the concrete spillway as analyzed.

Case 3 - Half PMF pool at EL 431.3 or 6.3 feet above spillway crest, tailwater estimated at 2 feet deep or 3.5 feet below spillway crest, full headwater and tailwater uplift, no flashboards, no silt load. The H & H analysis in Section 5.4 indicates that the flashboards should fail at or below a pool level 5.0 feet above the spillway crest.

Case 4 - Full PMF pool at EL 434.7 or 9.7 feet above spillway crest, tailwater estimated at 3 feet deep or 2.5 feet below spillway crest, remaining conditions same as Case 3.

The results of the stability analysis are summarized in Table 6.1. The computations are included as Appendix D.

For all loading cases analyzed, minimum satisfactory overturning stability is considered to be a factor of safety of 1.5 with the resultant passing through the middle third of the base. For sliding stability, because of the high loading conditions and the low strength assumptions made about foundation material properties, a minimum satisfactory factor of safety of 2.0 is considered appropriate for all the loading cases analyzed, rather than the customary 3.0. Both overturning and sliding stability must be satisfactory in order for stability of the section to be satisfactory.

As noted from Table 6.1, the spillway has unsatisfactory stability for the 1/2 PMF condition (Case 3) and is unstable for all other loading conditions. Included in the unstable rating are the normal spring-summer-fall condition (Case 1) and the winter ice load condition (Case 2).

'57? For Cases 3 and 4, the 1/2 PMF and PMF conditions, it should be noted that the full weight of the flowing water on the face of the spillway was taken into account as a resisting force. This results in factors of safety against overturning that appear satisfactory. However, considering that the shape of the spillway is like an ideal ogee (although it may not be exact) and that the 1/2 PMF and PMF have high heads and discharges, it is probable

TABLE 6.1

POTIC RESERVOIR DAM

STABILITY ANALYSIS OF GRAVITY SPILLWAY SECTION

CASE	OVERTURNING		SLIDING FACTOR OF SAFETY (c)
	FACTOR OF SAFETY (a)	LOCATION OF RESULTANT (b)	
1- Normal Pool with flashboards	1.40 unsatisfactory	0.36 b	1.0 unstable
2- Pool at Spillway Crest, no flashboards, Ice load	0.86 unstable	-0.15 b	0.77 unstable
3- Half PMF Pool, no flashboards	1.76 (d)	0.41 b	1.14 unsatisfactory
4- Full PMF Pool, no flashboards	1.52 (d)	0.33 b	0.91 unstable

(a) Overturning factor of safety is ratio of resisting moments to driving moments taken about the toe.

(b) Distance from toe to point where resultant passes through base, expressed in terms of base dimension "b". Middle third of base is 0.33b to 0.67b.

(c) Sliding factor of safety is ratio of horizontal resisting forces to horizontal driving forces taken along a failure plane sloping downstream.

(d) When weight of flowing water on face of spillway is neglected, FS = 0.96 for 1/2 PMF and 0.74 for PMF, both unstable conditions.

that the flowing water would exert little to no pressure - or even negative pressure - on the face of the spillway. Therefore, actual stability against overturning might be unsatisfactory, even to the point of becoming unstable. Analysis indicates that if the weight of flowing water on the face of the spillway is completely neglected, the spillway is in fact unstable against overturning for the 1/2 PMF and PMF conditions (see footnote (d) on Table 6.1 and Appendix D-14).

In view of the apparent unsatisfactory stability and instability of the spillway, it is recommended that a detailed structural stability investigation of the spillway be conducted to better assess its stability under all loading conditions. This should include appropriate field and laboratory work to determine the actual properties of the rock foundation under the spillway and structural details. The investigation should determine what modifications to the spillway, if any, are necessary to achieve satisfactory stability.

SECTION 7

ASSESSMENT AND RECOMMENDATIONS

7.1 ASSESSMENT

a. Safety

Visual inspection of Potic Reservoir Dam revealed the following deficiencies which affect the safety of the dam:

1) Unknown seepage through the dam where miscellaneous fill has been discarded on a portion of the downstream slope.

2) A reservoir level gauge (observation well) that penetrates the clay core and potentially may permit direct contact between the reservoir water and the core.

3) Seepage along the concrete box diversion conduit that encloses the outlet pipe through the embankment.

4) Deterioration and undermining of the downstream end of the left concrete training wall of the spillway discharge channel.

5) Trees growing on the slopes and in the riprap.

6) Zones of damaged riprap on the upstream slope.

Hydrologic and hydraulic analysis indicates that the dam would not be overtopped by the PMF. The PMF peak outflow due to reservoir routing is about 96% of maximum spillway discharge capacity. Therefore, in accordance with Corps of Engineers' screening criteria for review of spillway adequacy, the spillway is considered "adequate".

Structural stability analysis of the spillway section indicates unsatisfactory stability for the 1/2 PMF condition and instability for all other loading conditions, including the normal spring-summer-fall condition and the winter ice load condition.

b. Adequacy of Information

Available information together with that gathered during the visual inspection, while considered adequate for this Phase I inspection, is deficient in the following respects:

1) Miscellaneous fill on a portion of the downstream slope prevents adequate inspection in that area.

2) Water inside the diversion conduit that encloses the outlet pipe through the embankment prevents adequate inspection of those items.

3) There are no data available on the actual material properties of the rock foundation under the spillway. The lack of such data critically affects the structural stability analysis of the spillway.

4) Minor inconsistencies in the engineering data available, based on field observation and checking, are itemized in Section 2.4c.

c. Need for Additional Investigations

The following investigations should be performed by a registered professional engineer qualified by training and experience in the design of dams:

1) Inspect the downstream side of the dam after the miscellaneous fill has been removed.

2) Measure the piezometric pressure in the embankment downstream of the core as recommended in Section 2.1c.

3) Investigate and monitor seeps along the concrete box diversion conduit, other selected seeps in the vicinity, and seeps that may be uncovered by removal of the miscellaneous fill.

4) Perform a detailed structural stability analysis of the spillway to better assess its stability under all loading conditions. This should include appropriate field and laboratory work to determine the actual properties of the rock foundation under the spillway and structural details.

d. Urgency

As recommended below in Section 7.2a, within 3 months, after receipt of this Phase I Inspection Report by the Owner the toe of the dam should be exposed by removing the miscellaneous fill that was placed on a portion of the downstream side of the dam. Within 6 months after receipt of this report by the Owner, the investigations recommended above in Section 7.1c should be started.

Any remedial work deemed necessary as a result of these investigations should be completed within 18 months after receipt of this report by the Owner. A qualified, registered professional engineer should design and observe the construction of any necessary remedial work.

Measures recommended below in Section 7.2b should be completed within 12 months after receipt of this report by the Owner.

7.2 RECOMMENDED MEASURES

The following work should be performed by the Owner. Where engineering assistance is indicated, the Owner should engage a registered professional engineer qualified by training and experience in the design of dams. Assistance by such an engineer may also be useful for some of the other work.

a. Complete Within 3 Months

Expose the toe by removing the miscellaneous fill that was placed on a portion of the downstream side of the dam.

b. Complete Within 12 Months

1) Institute a program to visually inspect - not just casually look at - the dam and its appurtenances at least once a month.

2) Implement plans to uncover and provide easy access to the operating nut of the blowoff valve.

3) Dewater the inside of the concrete box diversion conduit through the dam and have it inspected by an engineer.

4) Repair the deteriorated and undermined downstream end of the left training wall of the spillway discharge channel, as well as other minor problems along the wall, in accordance with design and field observation of the work by an engineer.

5) Grout shut the reservoir level gauge (observation wall) in accordance with specifications and field observation of the work by an engineer.

6) Remove trees, brush, and their root systems from the slopes and to a distance of 20 feet downstream from the toe in accordance with specifications and field observatin of the work by an engineer. Fill resulting holes with properly selected, compacted fill. Continue to keep these same areas and the crest of the dam clear by cutting, mowing, and cleanup at least annually.

7) Backfill animal holes on the downstream slope with proper fill.

8) Repair riprap where it has been damaged and where it has been distrubed by removal of trees, brush, and roots, all in accordance with specifications and field observation of the work by an engineer.

9) Repair the uppermost gate stem guide on the downstream gate in the intake structure.

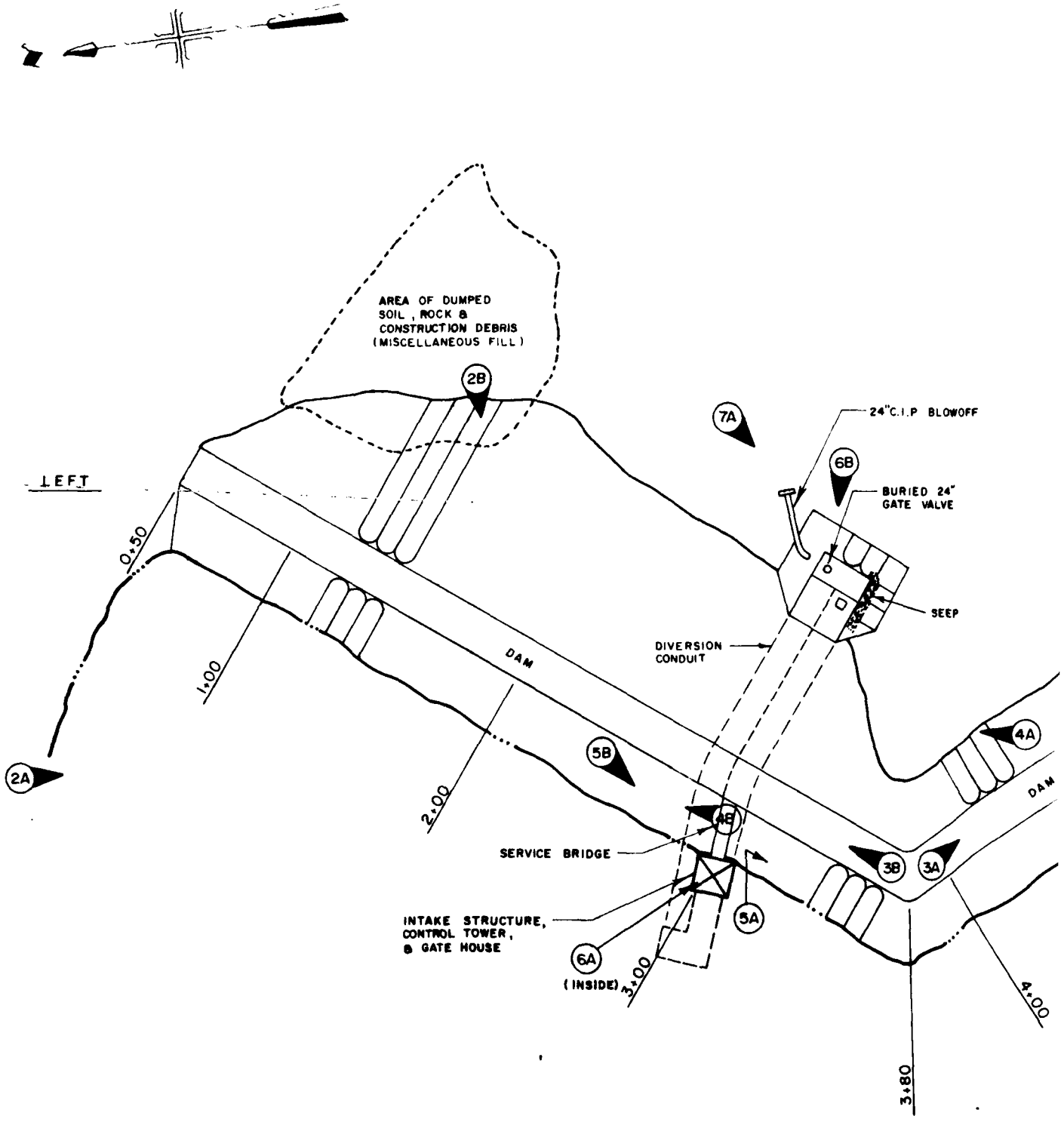
10) Develop and implement effective routine operation and maintenance procedures for the dam and its appurtenances. The sluice gates and blowoff valve should be exercised regularly.

11) Institute a program of comprehensive technical inspection of the dam and its appurtenances by an engineer on a periodic basis of at least once every two years.

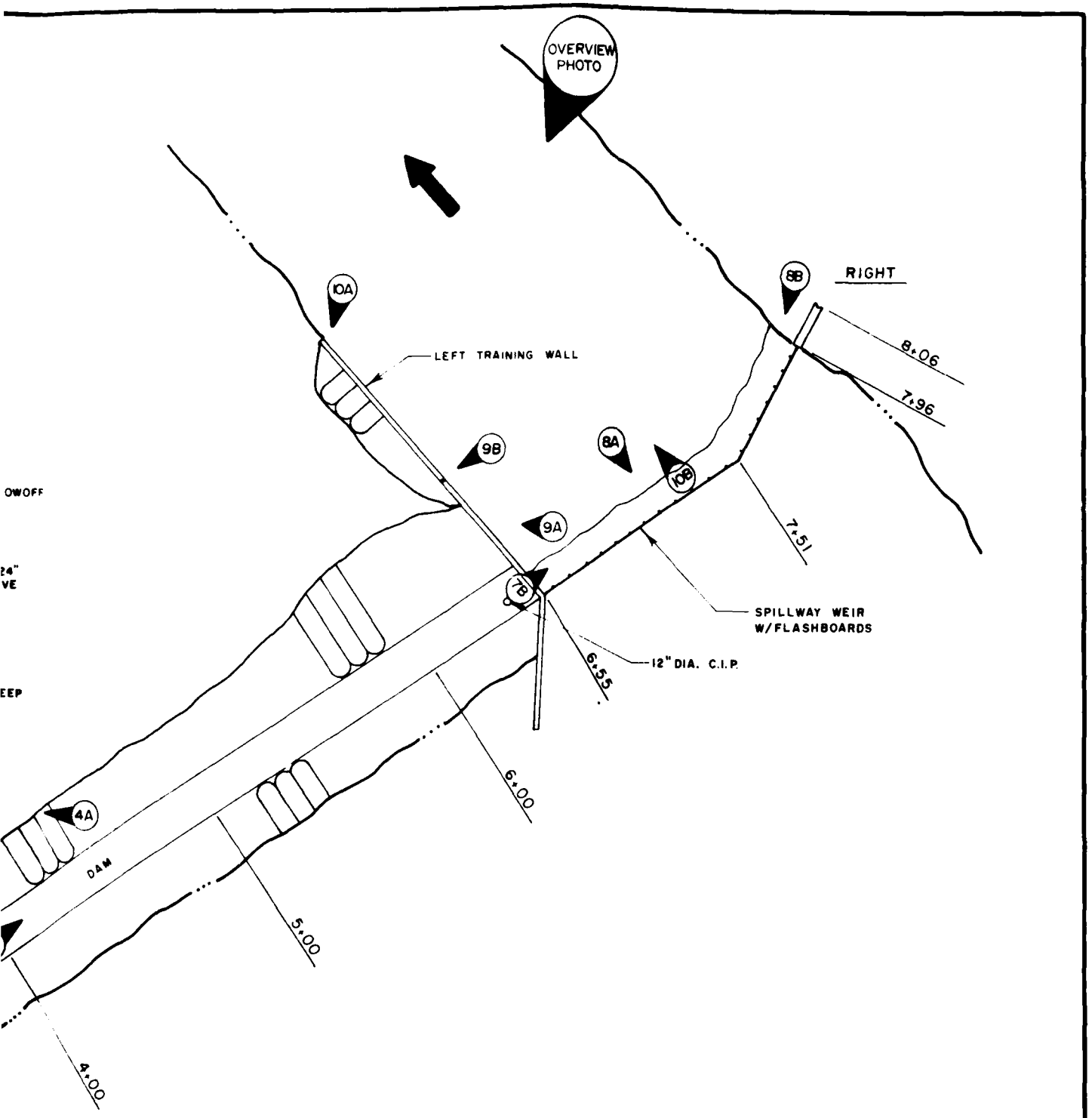
12) Develop an emergency action plan outlining action to be taken to minimize the downstream effects of an emergency, together with an effective warning system.

APPENDIX A

PHOTOGRAPHS



POTIC RESERVOIR



POTIC RESERVOIR DAM
PHOTO INDEX MAP

TOWN OF COXSACKIE	GREENE CO., N.Y.
SCALE NONE	DATE JULY 1981

C.T. MALE ASSOCIATES, P.C.
3000 TROY ROAD, SCHENECTADY N.Y. 12309
PROFESSIONAL ENGINEERS LAND SURVEYORS LAND PLANNING CONSULTANTS

PROJECT NO. 58-01-00009/80.849

A-1

DWG. NO. 81-13

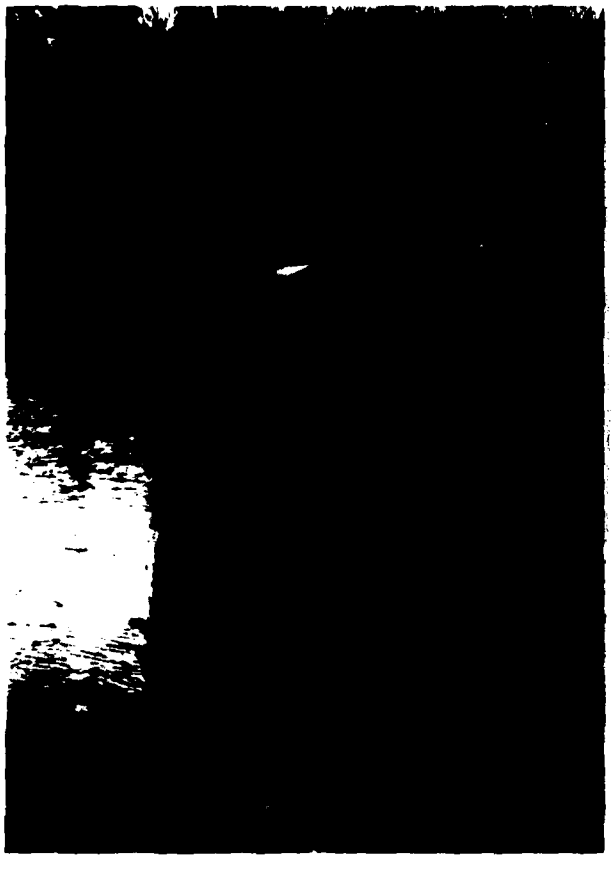
A-2A Upstream slope of dam looking toward right abutment 4/9/81

A-2B Downstream slope of dam looking from area recently filled with rock and construction debris - 4/9/81

A-3A Top of dam from bend point looking toward right abutment 4/9/81

A-3B Top of dam from bend point looking toward left abutment 4/9/81

A-4A Downstream slope of dam from a point on the dam between the bend point and the spillway - 4/9/81

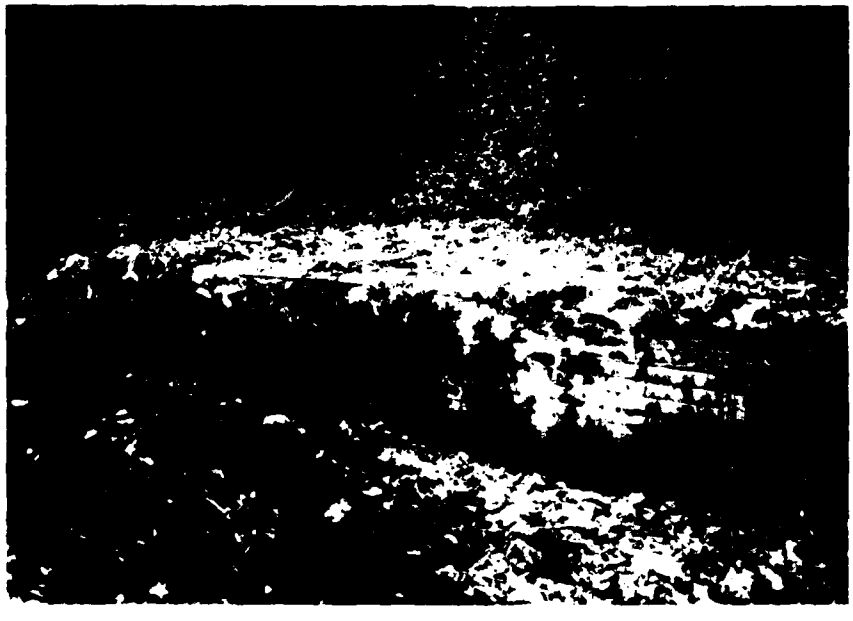


A-4B Upstream slope of dam from service bridge looking toward left abutment 4/9/81

A-5A Zone of damaged riprap at waterline near gate house - 4/9/81

A-5B Gate house and service bridge - 4/9/81

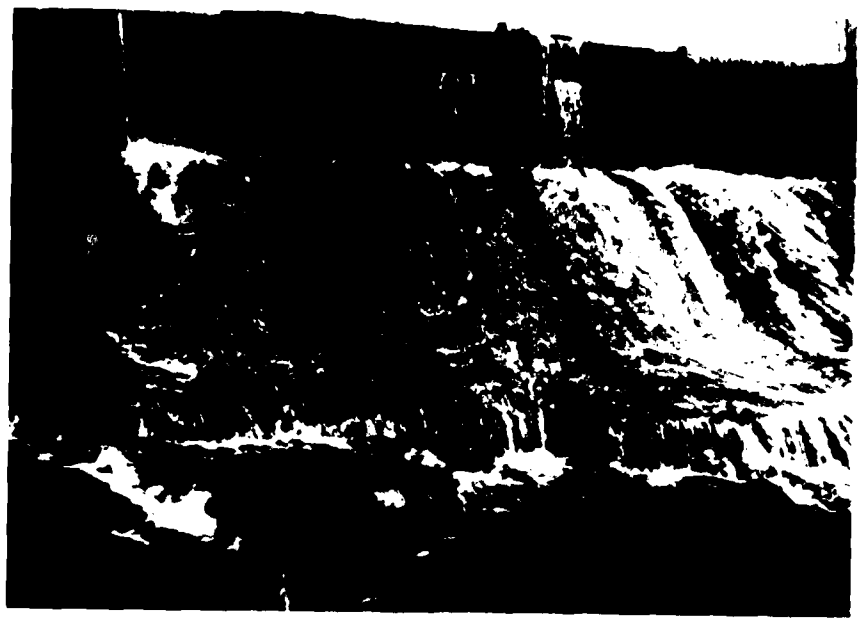
A-6A Hand crank, bevel gear floor stand controls for slide gates 4/9/81



A-6B Downstream end of old diversion conduit. Water is due to seep next to conduit, left side of photo - 4/9/81

A-7A Downstream end of 24-inch blowoff pipe - 4/9/81

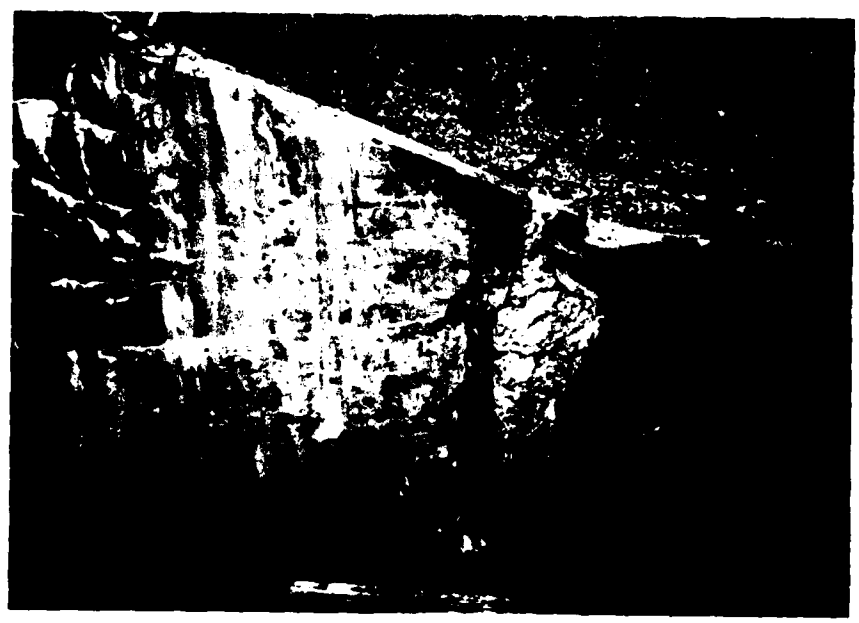
A-7B Ogee spillway weir cap looking toward right abutment 4/9/81



A-8A Ogee spillway weir cap looking upstream. Note irregular nature of ogee toe - 4/9/81

A-8B Ogee spillway weir cap looking toward left abutment 4/9/81

A-9A Left training wall of spillway downstream from weir - 4/9/81



A-9B Spalling at change of top slope of left training wall - 4/9/81

A-10A Downstream end of left training wall. Note undermining of wall 4/9/81

A-10B Spillway discharge channel looking downstream - 4/9/81

APPENDIX B

VISUAL INSPECTION CHECKLIST

PHASE I

VISUAL INSPECTION CHECKLIST

1. BASIC DATA

a. General

Name of Dam Potic Reservoir Dam

Fed. I.D.# NY00849 DEC Dam No. 209 - 810

River Basin LOWER HUDSON

Location: Town COXSACKIE County GREENE

Stream Name COB CREEK

Tributary of POTIC CREEK

Latitude (N) 42° 19.9' Longitude (W) 73° 55.0'

Type of Dam EARTH

Hazard Classification HIGH

Date(s) of Inspection April 9, 1981

Weather Conditions OVERCAST & COOL, CHANGED TO RAIN

Reservoir Level at Time of Inspection 428.2
(ABOUT 2" ABOVE FLASHBOARDS)

b. Inspection Personnel (*Recorder) THOMAS BENNEDUM - CTM, EDWIN VOPELAK JR.* - CTM, STEVE J. POULOS* - GEI

c. Persons Contacted (Including Title, Address & Phone No.)

RICHARD "RIP" CLEARWATER, WATER PLANT OPERATOR
HOME (518) 945 - 2666
RD BOX 20, EARLTON, NY 12058 PLANT (518) 945-1839

LARRY GAMBARATO, REPRESENTAIVE OF JOHN D. RUSACK P.C.*
285 MAIN ST., CATSKILL, NY 12414 (518) 943-3073

* CONSULTING ENGINEER TO VILLAGE

d. History

Date Constructed 1930 Date(s) Reconstructed N/A

Designer HAZEN & EVERETT, CIVIL ENGINEERS, 25 WEST 43RD ST. NY, N.Y.
(CHESTER M. EVERETT)

Constructed By UNKNOWN

Owner VILLAGE OF CATSKILL, 422 MAIN ST., CATSKILL, NY 12414, ATTN: JOSEPH IZZO, VILLAGE PRESIDENT

1568 Name of Dam Potic Reservoir Dam Date Apr. 9, 1981 2

2. EMBANKMENT

a. Characteristics

GEI 1) Embankment Material Appears to be glacial till. Referred to as "uniform mixture of loam, sand, gravel and boulders" in application forms.

GEI 2) Cutoff Type Concrete wall through overburden (probably till and pervious streambed) 8 to 18 ft deep and 3 ft thick. Grouted holes 10 ft deep 8 ft o.c. below

GEI 3) Impervious Core Central core 10 ft wide at crest and sloping 1H:3V ea. side, composed of "mixture of clay and other suitable material placed in alternate layers and thoroughly mixed together and compacted by the action of the grooved roller."

GEI 4) Internal Drainage System None. Rockfill toe at highest portion of dam to left of culvert.

GEI 5) Miscellaneous A large fill of rock and debris has been placed against the downstream slope. It obscures seepage from the highest zone of the dam. About Sta 1+50 to Sta 2+50.

GEI b. Crest

GEI 1) Vertical Alignment Satisfactory

GEI 2) Horizontal Alignment Satisfactory

GEI 3) Lateral Movement None observed

GEI 4) Surface Cracks None observed.

GEI 5) Miscellaneous Angle point in plan at Sta 3+85 Vertex is upstream. Spillway also has angle point.

GEI c. Upstream Slope

GEI 1) Slope (Estimate H:V) 2.75H:1V

GEI 2) Undesirable Growth or Debris, Animal Burrows

Minor growth of brush (at normal pool) and a few trees to 6 in. size.

GEI 3) Sloughing, Subsidence or Depressions

None - see slope protection.

GEI 4) Slope Protection Flat riprap laid on edge. Long side 8-14 in. Pushed 1 ft above surface by ice or frost at several locations, esp. to right of gatehouse.

GEI 5) Surface Cracks or Movement at Toe

Toe not visible

GEI d. Downstream Slope

GEI 1) Slope (Estimate - H:V) ~2.25H:1V

GEI 2) Undesirable Growth or Debris, Animal Burrows
Animal holes: Sta 4+45, 8ft down, 4 in.ϕ; Sta 3+00, 7ft down, 3 in.ϕ
Trees to 8 in deciduous, to 10 in. evergreen. Forested. Probably was cut to 15 years ago or so.

GEI 3) Sloughing, Subsidence or Depressions

None

GEI 4) Surface Cracks or Movement at Toe None.

GEI 5) Seepage Rt. side of outlet conduit - 5 gpm clear; Sta 3+10 at contact bet. toe and natural ground - seep wet but not running - << 1 gpm.

GEI 6) External Drainage System (Ditches, Trenches, Blanket)

None. Rockfill toe to left of conduit at high portion of dam.

GEI 7) Condition Around Outlet Structure Ground is soft due to seepage along conduit. Conduit filled with water to within 2 ft from top.

GEI 8) Seepage Beyond Toe Sta 2+80, 50 ft ds from toe - 12 ft ϕ wet area flowing clear at 5-10 gpm. Sta 5+00, 150 ft ds fm toe - wet, zero flow. Sta 5+60, 160 ft ds fm toe - standing water. Sta 6+20, 180 ft ds from toe - clear at 1 gpm. Sta 6+50, 180 ft ds fm toe - << 1 gpm clear. Total seepage (to left of berm along discharge channel) is ~15 gpm.

GEI e. Abutments - Embankment Contact

All very good

GEI 1) Erosion at Contact None

GEI 2) Seepage Along Contact None

3. DRAINAGE SYSTEM

GEI a. Description of System None. There is a cast iron pipe (12 in.) located 6 ft ds. from the upstream crestline at Sta 6+50 (9.5 ft left of left training wall of spillway). It is in core and connected with pipe to reservoir for measuring reservoir level.

GEI b. Condition of System N.A.

GEI c. Discharge from Drainage System N.A.

4. INSTRUMENTATION (Monumentation/Surveys, Observation Wells, GEI Weirs, Piezometers, Etc.)

None - see 3a.

5. RESERVOIR

GEI a. Slopes Wooded. Evergreen and deciduous. Moderate slopes.

GEI b. Sedimentation Not observed. Owners representative indicated no problems have developed.

GEI c. Unusual Conditions Which Affect Dam 6a. None noted

6. AREA DOWNSTREAM OF DAM

a. Downstream Hazard (No. of Homes, Highways, etc.) ABOUT 1000' ± D/S ARE CATSKILL WATER FILTRATION PLANT, SEVERAL BUILDINGS & TOWN ROAD BRIDGE

GEI b. Seepage, Growth Fully forested. Seepage noted at 2 d.s.

GEI c. Evidence of Movement Beyond Toe of Dam None

d. Condition of Downstream Channel WIDE NEAR SPILLWAY BUT NARROWS FURTHER D/S, DROPS OFF STEEPLY, BRUSH & TREES SCATTER IN CHANNEL, HEAVY GROWTH ON D/S BANKS

7. SPILLWAY(S) (Including Discharge Channel)

a. General CONCRETE OGEE WEIR CAP KEYED INTO ROCK W/ A BEND POINT TOWARD U/S, HAS 3' HIGH WOODEN FLASHBOARDS SUPPORTED BY STEEL PIPES (2" PIPE W/ 1½" PIPE INSIDE) EVERY 4½' "AUXILIARY" SPILLWAY IS AN AREA OF NATURAL GROUND & RIGHT ABUTMENT WHICH CAN ACT AS OVERFLOW AREA

b. Conditon of Service Spillway SPALLING OF CONCRETE IN PAST BUT PATCHING NOW @ WATER LEVEL @ U/S END OF LEFT TRAINING WALL TOE OF OGEE BROKEN OFF IN SPOTS, OGEE OVERHANGING ROCK 1'± IN SOME PLACES, SOME DETERIORATION OF CONSTRUCTION JOINTS IN OGEE SECTION, OVERALL OGEE SECTION IN GOOD SHAPE

c. Condition of Auxiliary Spillway AREA OF NATURAL GROUND HAS SOME LARGE TREES, RIGHT ABUTMENT CONCRETE IN GOOD SHAPE

d. Condition of Discharge Channel SEVERE SCALING TOP OF LEFT TRAINING WALL, SPALLING @ JOINT @ CHANGE OF SLOPE & AT NEXT JOINT 20'± D/S. SEVERE SCALING & UNDERMINING OF D/S END OF LEFT TRAINING WALL, ALSO STAINING & EFFLORESCENCE ALL OVER THE ENTIRE LEFT TRAINING WALL.

8. RESERVOIR DRAIN/OUTLET

a. Type: Pipe ✓ (INSIDE CONDUIT) Conduit _____ Other _____

b. Material: Concrete _____ Metal ✓ Other _____

c. Size: * SEE g. BELOW Length _____

d. Invert Elevations: Entrance ~403 AT INTAKE Exit ~403 AT BLOWOFF

e. Physical Condition (Describe)

Unobservable ✓ EXCEPT FOR EXPOSED END OF 24" BLOWOFF

1) Material CAST IRON

2) Joints _____ Alignment EXPOSED PORTION GOOD, REMAINDER UNKNOWN

3) Structural Integrity GOOD

4) Hydraulic Capability GOOD, NO REAL CHANNEL AT D/S END

f. Means of Control: U/S Gate ✓ D/S Valve ✓ (AT FILTRATION PLANT) Uncontrolled ___

Operation: Operable ✓ Inoperable ___ Other _____

Present Condition (Describe) U/S GATE PROTECTED BY GATE HOUSE & IN GOOD CONDITION, D/S VALVE ON BLOWOFF OPERABLE BUT BURIED, D/S VALVE ON RAW WATER MAIN AT FILTER PLANT IN GOOD CONDITION

g. Other Outlets (water mains, diversion pipes) _____

36" CIP INTAKE, NECKING DOWN TO 24" CIP THOUGH DAM IN RIGHT CHAMBER OF 14' x 7' CONCRETE DIVERSION TUNNEL, NOW CLOSED (EACH CHAMBER 7' SQUARE) AT D/S SIDE OF DAM THERE IS A TEE TO A 24" CIP BLOWOFF, W/ VALVE, NORMALLY CLOSED. ALSO AT TEE PIPE NECKS DOWN TO A 16" CIP RAW WATER MAIN TO FILTER PLANT WHERE FLOW IN MAIN IS CONTROLLED BY AN AUTOMATIC FLOAT-ACTUATED VALVE

0920 Name of Dam Potic Reservoir Dam Date Apr. 9, 1981 7

9. STRUCTURAL

a. Concrete Surfaces LEFT TRAINING WALL - SPALLING AT JOINTS, AREAS OF EFFLORESCENCE & STAINING ALL OVER WALL, OTHER CONCRETE SURFACES IN GOOD SHAPE

b. Structural Cracking TOE OF OGEE BROKEN OFF IN SOME PLACES, MINOR HAIRLINE CRACKING ON MOST CONC., CRACK IN TOP OF BLOWOFF HEADWALL

c. Movement - Horizontal & Vertical Alignment (Settlement) NONE

GEI d. Junctions with Abutments or Embankments Very good

GEI e. Drains - Foundation, Joint, Face None

f. Water Passages, Conduits, Sluices 2 BARRELLED (2-7' SQUARE CHAMBERS) CONCRETE CONDUIT, WAS USED FOR DIVERSION DURING CONSTRUCTION. LEFT ONE EMPTY & RIGHT ONE CONTAINS OUTLET PIPE. U/S ENDS BOTH CONDUITS UNOBSERVABLE D/S ENDS OF BOTH SEALED W/ BRICK MASONRY WHICH IS BREAKING UP & DETERIORATING, CONC AT TOP OF D/S ENDS IS SCALING, HAS HAIRLINE CRACKING & EFFLORESCENCE

GEI g. Seepage or Leakage SEEP AT RIGHT SIDE OF CONDUIT (SEE 2.d.5 & 7) RIGHT CONDUIT FILLED W/ WATER TO WITHIN 2'± OF TOP

h. Joints - Construction, etc. SPALLING AT JOINTS IN LEFT TRAINING WALL FAIRLY SEVERE, SPILLWAY OGEE SECTION CONSTRUCTION JOINTS GOOD W/ MINOR SPALLING

GEI i. Foundation Spillway ogee is on bedrock (shale or sandstone) with bedding dipping NE 10°. Beds are 2 in. to 10 in. thick.

GEI j. Abutments Right abutment is glacial till ~5ft thick over bedrock. Left abutment is till over bedrock.

k. Control Gates 2 GATES IN GATE HOUSE. ONE CONTROLS FLOW INTO BOTTOM OF GATE HOUSE ON U/S SIDE & OTHER CONTROLS OUTFLOW TO OUTLET CONDUIT, BOTH OPERABLE & IN GOOD CONDITION TOP STEM GUIDE ON D/S GATE STEM IS BROKEN & DETACHED FROM STEM.

l. Approach & Outlet Channels SPILLWAY APPROACH IS LAKE SECTION ABOUT 4' DEEP BELOW CONCRETE WEIR CREST & IS IN GOOD CONDITION W/ MINOR DEBRIS ON FLASHBOARDS. D/S SPILLWAY IS WIDE W/ ROCK BOTTOM THAT DROPS OF QUICKLY. GENERALLY CLEAR W/ SOME LARGE TREES IN CHANNEL D/S OF OGEE. NO DEFINED CHANNEL D/S OF BLOWOFF, JUST WOODS.

m. Energy Dissipators (Plunge Pool, etc.) NATURAL ROCK FORMS CHANNEL BOTTOM W/ NO ENERGY DISSAPATORS

n. Intake Structures STEEL TRASH RACKS ON TOP PORTION OF INTAKE VISABLE & IN GOOD SHAPE W/ SOME RUST. REMAINDER OF INTAKE IS SUBMERGED.

o. Stability

p. Miscellaneous

8876 Name of Dam Potic Reservoir Dam Date Apr. 9, 1981 9

10. APPURTENANT STRUCTURES (Power House, Lock, Gatehouse, Service Bridge, Other)

a. Description: GATE HOUSE - BRICK STRUCTURE W/ WOOD FRAME ROOF ON TOP OF POURED CONCRETE INTAKE STRUCTURE. SERVICE BRIDGE - CONCRETE BRIDGE DECK W/ STEEL PIPE HAND RAILS

b. Condition: GATE HOUSE - GOOD CONDITION, MINOR CRACKING ON CONTROL TOWER, SERVICE BRIDGE - GOOD CONDITION BUT RAILING IS LOOSE. RAILING & WOOD PORTIONS OF GATE HOUSE NEED PAINTING

11. MISCELLANEOUS MECHANICAL/ELECTRICAL EQUIPMENT

a. Description: FLOAT LEVEL STAFF GAGE IN GATE HOUSE BROKEN. RESERVOIR LEVEL GAGE (12"CIP) NEXT TO LEFT SPILLWAY TRAINING WALL ON DAM CREST APPEARS OPERABLE BUT NOT USED.

b. Condition: SEE a. ABOVE

12. OTHER

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APPENDIX C

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

CHECKLIST AND COMPUTATIONS

TABLE OF CONTENTS

4595

PHASE I INSPECTION

HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA CHECKLIST

Name of Dam POTIC RESERVOIR DAM Fed. Id.# NY00307

1. AREA-CAPACITY DATA

	Elevation (ft.)	Surface Area (acres)	Storage Capacity (acre-ft.)
a. Top of Dam	435	125.9 EST.	1,550
b. Design High Water (Max. Design Pool)	432.5 ±	109.3 EST.	1,239 EST.
c. "Auxiliary" Spillway Crest *	431 AVG.	99.4 EST.	1,053 EST.
d. Pool Level with Flashboards	428	79.27 **	757
e. Service Spillway Crest	425	70 EST.	536

* OVERFLOW AREA TO RIGHT OF SERVICE SPILLWAY LOOKING D/S
** EXCLUDES ISLANDS

2. DISCHARGES

	Volume (cfs)
a. Average Daily	UNKNOWN
b. Spillway @ Top of Dam* (ASSUMES FLASHBOARDS HAVE FAILED)	15,800
c. Spillway @ Design High Water (APPENDIX F3-40)	10,000
d. Service Spillway @ "Auxiliary" Spillway Crest Elevation (ASSUMES FLASHBOARDS HAVE FAILED)	6,900
e. Low Level Outlet (AVG. DRAFT = 1.5 MGD ≈ 2.3 cfs)	2
f. Total (of all facilities) @ Top of Dam	15,800
g. Maximum Known Flood (PER OPERATOR, OCCURRED MARCH 1980, BASED ON 10" OVER FLASHBOARD CREST)	350 ≐ 18 cms
h. At Time of Inspection	~30

* BOTH SERVICE + "AUXILIARY" SPILLWAY TOGETHER:
SERVICE SPILLWAY @ TOP OF DAM - 14,800 cfs
"AUXILIARY" SPILLWAY @ TOP OF DAM - 1000 cfs

4596

3. TOP OF DAM

Elevation 435

a. Type EARTH FILL W/ CLAY CORE + GRAVITY SPILLWAY SECTION

b. Width 16' Length 756' (605' EARTH DAM W/O SPILLWAYS)

c. Spillover SERVICE SPILLWAY

d. Location AT RIGHT ABUTMENT OF DAM LOOKING D/S

4. SPILLWAY

	SERVICE	AUXILIARY
a.	425 W/O FLASHBOARDS 428 W/ FLASHBOARDS	Elevation 431 AVG.
b.	OGEE	Type OVERFLOW (10' CONC. + 30' NAT'L GROUND)
c.	141'	Width ~40'
d.	Type of Control	Uncontrolled ✓
e.	FLASHBOARDS	Controlled: Type (Flashboards; gate)
f.	31 BAYS	Number
g.	3' HIGH, EACH BAY ~4.5'	Size/Length
h.	CONCRETE	Invert Material 10' CONC., 30' NAT'L GROUND
i.		Anticipated Length of Operating Service
j.	150' ROCK CHANNEL	Chute Length NONE (NAT'L GROUND)
k.	~5'	Height Between Spillway Crest & Approach Channel Invert (Weir Flow) ~0' TO 4'
l.		Other

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5. OUTLET STRUCTURES/EMERGENCY DRAWDOWN FACILITIES

a. Type: Gate____ Sluice____ Conduit ✓ Penstock____

b. Shape 36" CIP GATED INTAKE, NECKING DOWN TO 24" CIP THROUGH DAM. AT D/S SIDE OF DAM THERE IS A TEE TO A 24" CIP BLOWOFF, WITH VALVE NORMALLY CLOSED. ALSO AT TEE PIPE NECKS DOWN TO A 16" CIP

c. Size RAW WATER MAIN TO FILTER PLANT.

d. Elevations: Entrance Invert ~ 403 AT INTAKE

Exit Invert ~ 403 AT BLOWOFF

e. Tailrace Channel: Elevation N/A

6. FLOOD WATER CONTROL SYSTEM

a. Warning System NONE

b. Method of Controled Releases (mechanisms) WATER NORMALLY FLOWS TO WATER PLANT AT AVG. DRAFT OF 1.5 MGD (2 cfs). BLOWOFF OPERABLE BUT NEVER USED. FLOW OVER FLASHBOARDS DURING THE YEAR.

7. CLIMATOLOGICAL GAGES REFERENCES 21+22 (ALSO RAIN GAGE @ FILTER PLANT)

a. Type NON-RECORDING TEMPERATURE + PRECIPITATION GAGE INDEX # 4025

b. Location HUDSON STATE SCHOOL LAT. 42°15', LONG. 73°48', 7 MILES SE. OF DAM

c. Period of Record 1956 TO PRESENT

d. Maximum Reading UNKNOWN Date____

8. STREAM GAGES REFERENCE 23, EXCEPT FOR WATER YEAR 1977

a. Type SURFACE WATER STATION USGS GAGE # 01359924

b. Location HANNACROIS CREEK NEAR NEW BALTIMORE

LAT. 42°26'22", LONG. 73°48'41", 9 MILES S.W. OF DAM

c. Period of Record OCT. 1967 TO SEPT. 1977 (DISCONTINUED PRIOR TO WATER YEAR 1979)

d. Maximum Reading 1,780 cfs = 28.9 cms Date JULY 1, 1973

9. OTHER

PER REF. 24, AT POTIC CREEK NEAR EARLTON, ABOUT 2 MI NE OF DAM, MAX KNOWN DISCHARGE = 1230 cfs = 98.4 cms ON DEC. 11, 1952.

6169

10. DRAINAGE BASIN CHARACTERISTICS

a. Drainage Area 19.601 SQ. MILES OR 12,544.7 ACRES

b. Land Use - Type WOODLAND + FARMLAND

c. Terrain - Relief FAIRLY FLAT W/ SLOPES OF 1% TO 10%
ELEVATIONS VARY FROM EL 425 TO EL 1110.

d. Surface - Soil GLACIAL TILL

e. Runoff Potential (existing or planned extensive alterations to existing surface or subsurface conditions)

NONE KNOWN.

f. Potential Sedimentation Problem Areas (natural or man-made; present or future)

NONE KNOWN.

g. Potential Backwater Problem Areas for Levels at Maximum Storage Capacity (including surcharge storage)

ROADWAY THROUGH RESERVOIR (SEE h.) WOULD BE OVERTOPPED BY 3' FOR WATER LEVELS AT TOP OF DAM, EL 435.

ROAD IS TOWN HIGHWAY 43 (SCHOHARIE TURNPIKE)

h. Dikes - Floodwalls (overflow & non-overflow) - Low Reaches Along the Reservoir perimeter

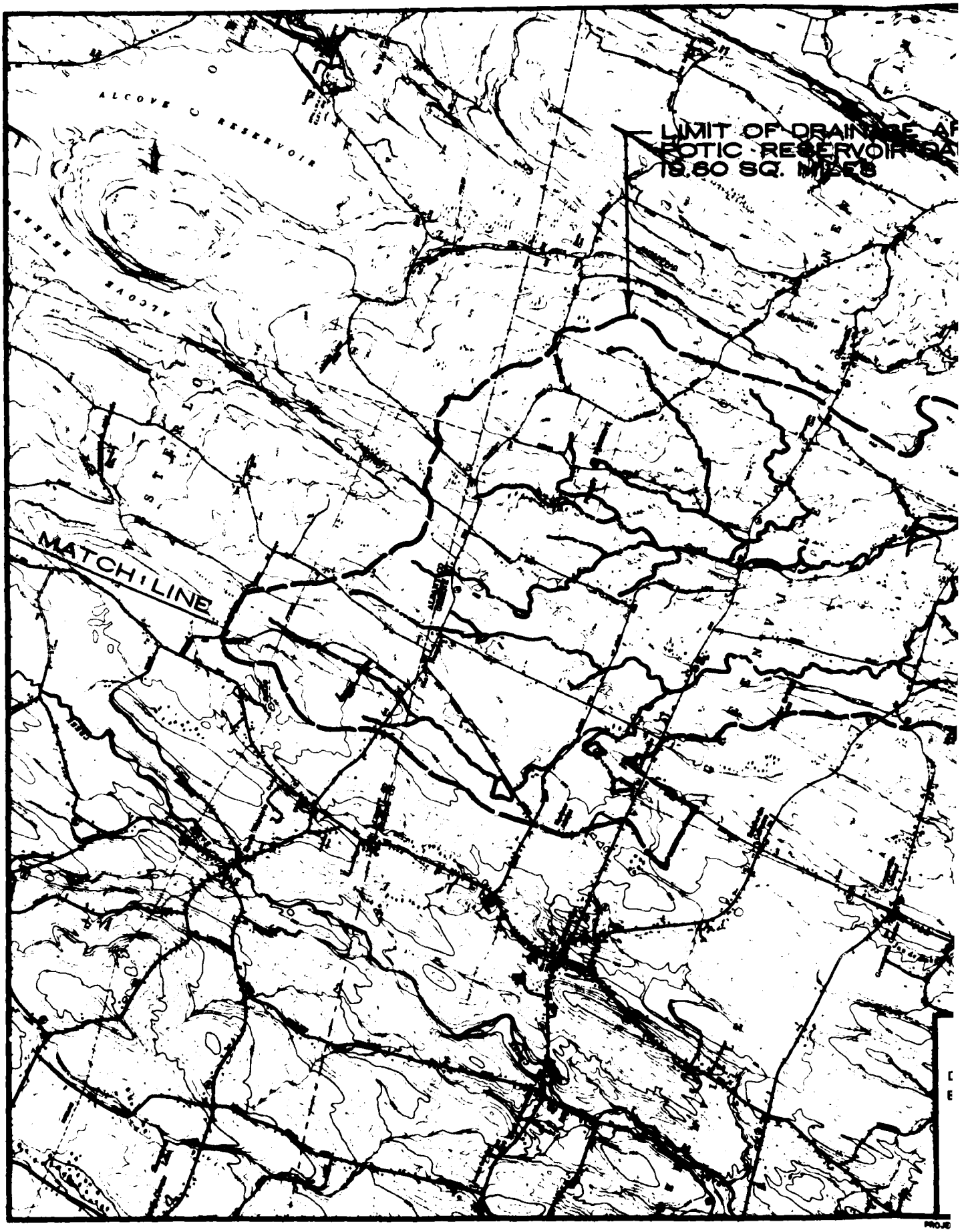
Location ROADWAY EMBANKMENT W/ CULVERT THROUGH RESERVOIR
LOCATED IN SOUTHERN PART OF RESERVOIR EAST OF DAM

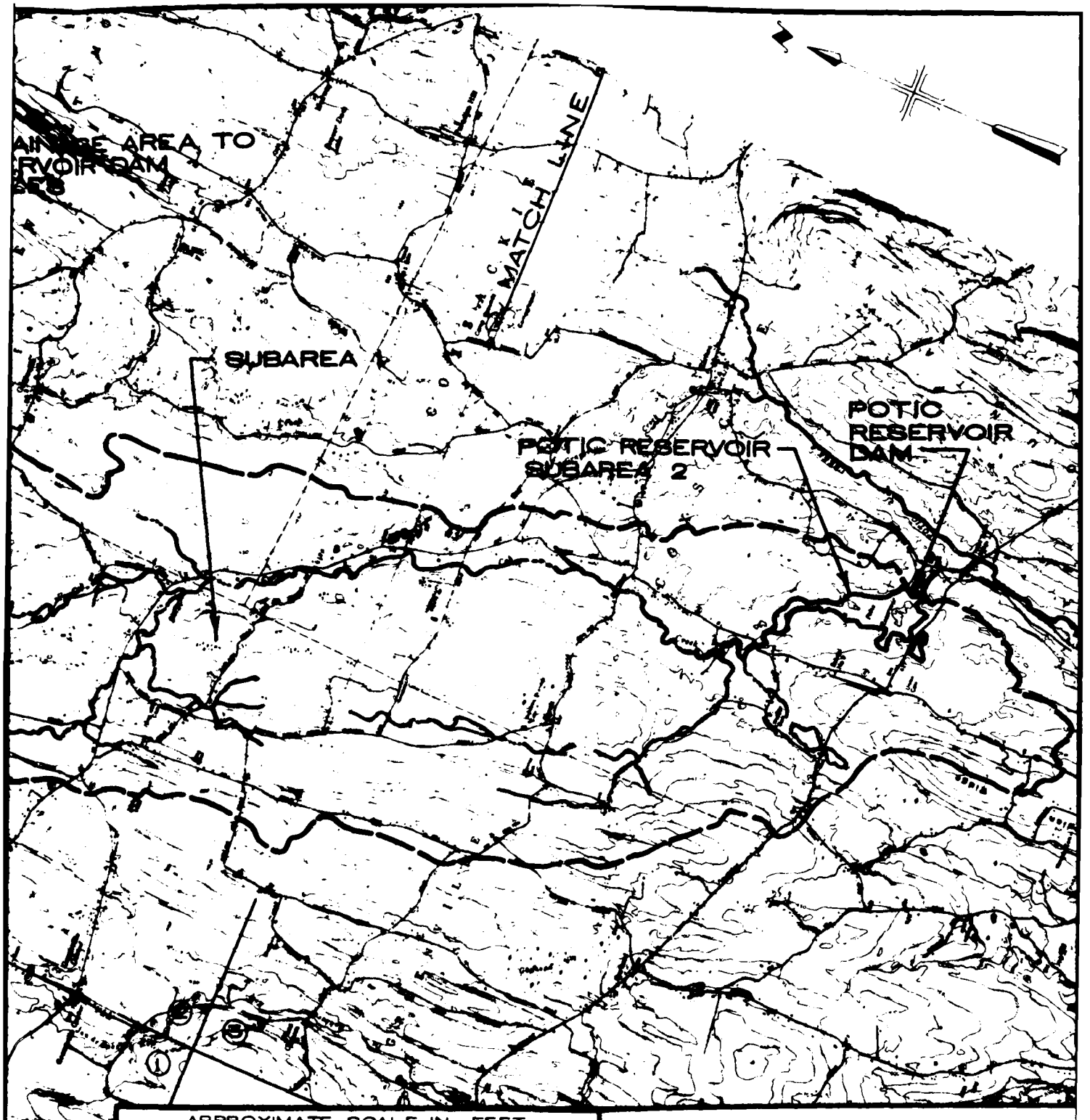
Elevation 432

i. Reservoir

Length @ Maximum Design Pool 4100 ± (feet)

Length of Shoreline (@ Service Spillway Crest) ~10,600 (feet)


ALCOVE RESERVOIR
ALCOVE
LIMIT OF DRAIN
EOTIC RESERVOIR
18.60 SQ. MILES
MATCH LINE



APPROXIMATE SCALE IN FEET
0 4000 8000

DATUM - NGVD 1929, 20' CONTOUR INTERVAL
BASE MAP - 7.5' NYSDOT TOPO QUADS
REDUCED 50 %
① GREENVILLE, NY - 1974
② ALCOVE, NY - 1974
③ LEEDS, NY - 1976

POTIC RESERVOIR DAM
DRAINAGE AREA MAP

TOWN OF COXSACKIE	GREENE CO., NY
SCALE 1"= 4000'	DATE JANUARY 1981

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COMPUTER SERVICES LANDSCAPE ARCHITECTURE LABORATORY SERVICES

JOB POTIC RESERVOIR DAM
SHEET NO ____ OF ____
CALCULATED BY ELV DATE 4/13/81
CHECKED BY [illegible] DATE 5/19/81
SCALE 58.01.00009

DRAINAGE AREA

	AREA (acres)	AREA (sq. miles)	
WATERSHED OF POTIC RESERVOIR (SUBAREA 1)	12,460.4	19.469	(1)
POTIC RESERVOIR SURFACE (SUBAREA 2) @ EL 428 (2) (INCLUDES ISLANDS)	84.29	.132	
	12,544.7	19.601	

(1) WATERSHED ABOVE RESERVOIR OF 19.3 SQ. MI. ACCORDING TO ORIGINAL PLANS BY HAZEN & EVERETT, APRIL 29, 1930. (SEE APPENDIX G-1)

(2) RESERVOIR AREA OF 79.27 ACRES W/O ISLANDS. SEE TOPOGRAPHIC MAP, APPENDIX G-8.

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JOB POTIC RESERVOIR DAM
SHEET NO ____ OF ____
CALCULATED BY CLV DATE 4/13/81
CHECKED BY [illegible] DATE 5/12/81
SCALE 58.01.00009

ELEVATION - AREA - STORAGE COMPUTATIONS

RESERVOIR VOLUME: FROM "STORAGE CAPACITY CURVE ~ IMPOUNDING RESERVOIR" BY BENJAMIN L. SMITH & ASSOCIATES FOR VILLAGE OF CATSKILL (1958). SEE APPENDIX G-7

	ELEVATION (NGVD - ft.)	AREA (acres)	STORAGE VOLUME (acre-feet)	
	398		—	MAY BE ANOTHER 10± ACRE-FEET OF DEAD STORAGE TO ABSOLUTE BOTTOM. DATA NOT CLEAR.
	400		—	
	402		—	
	404		—	
	406		0	
	408		8.9	
	410		22.7	
	412		42.3	
	414		71.8	
	416		114.2	
	418		174.9	
	420		253.2	
	422		352.9	
	424		469.6	
SPILLWAY CREST	425	70 EST.	536.1	
	426		598.5	
SPILLWAY CREST W/ FLASHBOARDS	428	79.27	756.8	
	430	92.8	928.2 *	
TOP OF DAM	435	125.9 EST.	1,550	CALC. BY COMPUTER
	440	158.9	2,172.5*	

* CALCULATED BY METHOD OF CONIC SECTIONS ($\Delta V_{12} = \left[\frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right)\right]$) USING AREAS DERIVED FROM CONTOUR INFORMATION ON PLAN, APPENDIX G-1.

Form CTM-105

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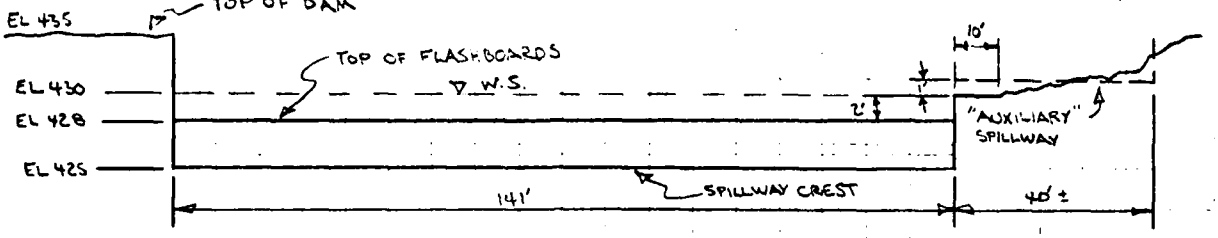
JOB POTIC RESERVOIR DAM
SHEET NO. ____ OF ____
CALCULATED BY ELV DATE 4/15/81
CHECKED BY [illegible] DATE 5/19/81
SCALE 58.01.00009

DISCHARGE COMPUTATIONS

SPILLWAY CAPACITY

SPILLWAY ELEVATION LOOKING D/S



FOR FLOW OVER MAIN SPILLWAY: $Q = 3.33LH^{1.5}$ (FORMULA FOR CRITICAL FLOW OVER SHARP-CRESTED WEIR, REF. 9)

SAME FORMULA USED FOR SPILLWAY W/ FLASHBOARDS @ EL 428 OR FOR SPILLWAY AT OGEE CREST W/ FLASHBOARDS FAILED, SPILLWAY CREST AT EL 425, FLASHBOARDS FAIL WHEN W.S. @ EL 430.

FOR FLOW OVER "AUXILIARY" SPILLWAY: $Q = 3.087LH^{1.5}$ (FORMULA FOR CRITICAL FLOW OVER BROAD-CRESTED WEIR, REF. 9)

ELEVATION (NGVD)	W/O FLASHBOARD FAILURE					W/ FLASHBOARD FAILURE @ W.S. EL 430				
	H_S (ft.)	$H_{AUX.S}$ (ft.)	Q_S (cfs)	$Q_{AUX.S}$ (cfs)	Q_{TOTAL} (cfs)	H_S (ft.)	$H_{AUX.S}$ (ft.)	Q_S (cfs)	$Q_{AUX.S}$ (cfs)	Q_{TOTAL} (cfs)
425 SPILLWAY CREST	0	0	0	0	0	0	0	0	0	0
428 FLASHBOARD CREST	0	0	0	0	0	0	0	0	0	0
429	1	0	470	0	470	1	0	470	0	470
430	2	0	1,328	0	1,328	2	0	1,328	0	1328
430.1	~2	0	~1,328	0	~1,328	~5	~0	5,250	0	5,250
431	3	0	2,440	0	2,440	6	0	6,901	0	6,901
432	4	1	3,756	123	3,879	7	1	8,696	123	8,819
433	5	2	5,250	349	5,599	8	2	10,624	349	10,973
434	6	3	6,901	642	7,543	9	3	12,677	642	13,319
435 TOP OF DAM	7	4	8,696	988	9,684	10	4	14,848	988	15,836
436	8	5	10,624	1381	12,005	11	5	17,130	1381	18,511
438	10	7	14,848	2,287	17,135	13	7	22,008	2287	24,295
								≈ 14,800	1,000	15,800

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COMPUTER SERVICES LANDSCAPE ARCHITECTURE LABORATORY SERVICES

JOB POTIC RESERVOIR DAM
SHEET NO ____ OF ____
CALCULATED BY ELV DATE 4/16/81
CHECKED BY [illegible] DATE 5/19/31
SCALE 58.01.00009

DISCHARGE COMPUTATIONS

DAM APPURTENANCE	ELEVATION (NGVD)	SIZE
SERVICE SPILLWAY	CREST EL = 425 W/O FLASHBOARDS CREST EL = 428 W/ FLASHBOARDS	141' CREST LENGT
"AUXILIARY" SPILLWAY	AVG. CREST EL = 431	40'± CREST LENGTH
DAM	CREST EL = 435	605' CREST LENGTH (EXCLUDES SPILLWAY)
OUTLET PIPE	INVERT EL = 403	*

* 36" CIP INTAKE, NECKING DOWN TO 24" CIP THROUGH DAM. AT D/S SIDE OF DAM THERE IS A TEE TO A 24" CIP BLOWOFF, WITH VALVE, NORMALLY CLOSED. ALSO AT TEE PIPE NECKS DOWN TO A 16" CIP RAW WATER MAIN TO FILTER PLANT. (REPORTED DRAFT ≈ 1.5 MGD ≈ 2.3 cfs WHICH IS MUCH LESS THAN $Q_{SPILLWAYS}$)

FOR FLOW OVER DAM: $Q = 3.087 L H^{1.5}$ (FORMULA FOR CRITICAL FLOW OVER BROAD-CRESTED WEIR, REFERENCE 9)

	ELEVATION (NGVD)	$H_{SEMICIRCLE\ SPILLWAY}$ (ft.)	$H_{AUX\ SPILLWAY}$ (ft.)	H_{DAM} (ft.)	$Q_{OUTLET\ PIPE}$ (cfs)	INPUT $Q_{SPILLWAYS\ (BOTH)}$ (cfs)	Q_{DAM} (cfs)	Q_{TOTAL} (cfs)		
SPILLWAY CREST	425	0	0	0	0	0	0	0		
FLASH BOARD CREST	428	0	0	0	ASSUMED CLOSED FOR MODEL DUE TO SMALL CAPACITY	0	0	0		
	429	1	0	0		470	0	470		
	430	2	0	0		1,328	0	1,328		
FLASHBOARD FAILURE →	430.1	~5	0	0		5,250	0	5,250		
	431	6	0	0		6,901	0	6,901		
	432	7	1	0		8,819	0	8,819		
	433	8	2	0		10,973	0	10,973		
	434	9	3	0		13,319	0	13,319		
TOP OF DAM	435	10	4	0		15,836	0	15,836	SAY	15,800
	436	11	5	1		18,511	1,868	20,379		
	438	13	7	3	0	24,295	9,705	34,000		

C-9

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JOB POTIC RESERVOIR DAM
SHEET NO. ____ OF ____
CALCULATED BY ELV DATE 4/13/81
CHECKED BY [illegible] DATE 5/19/81
SCALE 58.01.00009

DRAINAGE AREA DATA FOR HEC-1 DB MODEL

SUBAREA 1: AREA TRIBUTARY DIRECTLY TO RESERVOIR
AREA = 19.469 SQUARE MILES

LOSS RATES: 1.0" - INITIALLY
0.1"/HOUR - CONSTANT LOSS RATE

UNIT HYDROGRAPH PARAMETERS: USE SNYDER METHOD

A = DRAINAGE AREA = 19.469 SQUARE MILES
L = LENGTH OF MAIN WATERCOURSE TO UPSTREAM LIMIT OF DRAINAGE AREA = 10.42 MILES
L_{cA} = LENGTH ALONG MAIN WATERCOURSE TO POINT OPPOSITE THE CENTROID OF THE DRAINAGE AREA = 4.73 MILES
C_t = SNYDER'S BASIN COEFFICIENT = 2.1 (FROM REF 20)
C_p = SNYDER'S PEAKING COEFFICIENT = .500 (FROM REF. 20)
t_p = STANDARD LAG IN HOURS = $C_t(LL_{cA})^{0.3}$ = 6.76 HOURS

REQUIRED UNIT RAINFALL DURATION = t_r
$t_r = \frac{t_p}{5.5} = \frac{6.76}{5.5}$ = 1.23hr max
USE t_r' = 10 min < 1.23 hr OK

∴ USE t_p = 6.8 HOURS

SUBAREA 2: RESERVOIR SURFACE, AREA = .132 SQ. MILES = 84.29 ACRES
(INCLUDES ISLANDS = 5.02 ACRES ≈ 6% OF TOTAL)

LOSS RATES: NONE BECAUSE RAINFALL ≈ RUNOFF FOR WATER SURFACE
(NEGLECT SMALL AREA OF ISLANDS)

UNIT HYDROGRAPH PARAMETERS:

FOR U.H. W/ 10 MINUTE DURATION + 1" RAIN

$$\bar{Q} = \frac{A(1")}{t} = \frac{84.29 \text{ acres}\,(1")}{10 \text{ minutes}} \left(\frac{43{,}560 \text{ sq FT}}{1 \text{ acre}}\right)\left(\frac{1 \text{ FT}}{12 \text{ inches}}\right)\left(\frac{1 \text{ minute}}{60 \text{ seconds}}\right)$$

$\bar{Q}$ = 510 cfs (W/O LOSS RATE)

Form CTM-405

```
A NYD DAM INSPECTION: DACW51-81-C-0014
A NY00307, POTIC RESERVOIR DAM, 00.00849
A OVERTOPPING ANALYSIS  PRD2 FLASHBOARDS FAIL @ 2 FT OF HEAD
B    288       0      10                                          4
B1     5
J      1       2       1
J1   1.0     0.5
K      0    SA-1                                          1
K1 SUBAREA 1 RUNOFF COMPUTATION
M      1       1  19.469          19.601                           1
P             20     103     116     126     134
T                                                  1.0     .10
W    6.6     .50
X     -2       1
K      0    SA-2                                          1
K1 SUBAREA 2 (RESERVOIR) RUNOFF COMPUTATION
M      1      -1    .132          19.601                           1
P             20     103     116     126     134
T                                                    0       0
U      1
U1   510
X     -2       1
K      2   SA-2C                                          1
K1 COMBINING HYDROGRAPHS 1 & 2
K      1     RES                 2                        1
K1 ROUTING FLOWS THROUGH RESERVOIR
Y                                  1       1
Y1     1                                                -428      -1
Y4   428     429     430  430.10     431     432     433     434     435     436
Y4   438
Y5     0     470    1328    5250    6901    8819   10973   13319   15836   18511
Y5 24295
S      0     8.9    22.7    42.3    71.8   114.2   174.9   253.2   352.9   469.6
S  536.1   598.5   756.8   928.2  2172.5
E    406     408     410     412     414     416     418     420     422     424
E    425     426     428     430     440
E    428
D    435   3.087     1.5     605
K     99
A
A
A
A
A
```

PART

C-11

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

 RUN  DATE: 7/07/81
      TIME: 9:02 AM

                    NYD DAM INSPECTION: DACW51-81-C-0014
                    NY00307, POTIC RESERVOIR DAM, 8C.00849
                    OVERTOPPING ANALYSIS  PRD2 FLASHBOARDS FAIL @ 2 FT OF HEAD

                                        JOB SPECIFICATION
                      NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
                     288       0      10       0       0       0       0       0       4       0
                                          JOPER     NWT   LROPT   TRACE
                                              5       0       0       0

                                    MULTI-PLAN ANALYSES TO BE PERFORMED
                                          NPLAN= 1 NRTIO= 2 LRTIO= 1
                              RTIOS=   1.00   0.50

**********          **********          **********          **********          **********

                                    SUB-AREA RUNOFF COMPUTATION

                    SUBAREA 1 RUNOFF COMPUTATION
                                  ISTAQ   ICOMP   IECON   ITAPE   JPLT    JPRT   INAME  ISTAGE   IAUTO
                                   SA-1       0       0       0       0       0       1       0       0

                                              HYDROGRAPH DATA
                      IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                          1       1   19.47    0.00   19.60    0.00   0.000       0       1       0

                                              PRECIP DATA
                                SPFE     PMS      R6     R12     R24     R48     R72     R96
                                0.00   20.00  103.00  116.00  126.00  134.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS 0.822

                                              LOSS DATA
                     LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
                         0    0.00    0.00    1.00    0.00    0.00    1.00    1.00    0.10    0.00    0.00

                                          UNIT HYDROGRAPH DATA
                                    TP=  6.80    CP=0.50    NTA=  0

                                          RECESSION DATA
                                STRTQ=   -2.00    QRCSN=    0.00    RTIOR= 1.00

                    UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG=   6.81 HOURS, CP= 0.50  VOL= 0.76
                      4.      13.      28.      46.      66.      88.     112.     138.     166.     194.
                    224.     255.     287.     320.     354.     388.     423.     459.     496.     533.
                    570.     608.     644.     679.     711.     742.     771.     798.     823.     846.
                    868.     887.     905.     920.     934.     945.     954.     960.     964.     965.
                    963.     956.     943.     926.     909.     893.     877.     861.     845.     830.
                    815.     800.     786.     772.     758.     744.     731.     718.     705.     692.
                    680.     667.     655.     644.     632.     621.     609.     598.     588.     577.
                    567.     556.     546.     537.     527.     517.     508.     499.     490.     481.
                    473.     464.     456.     447.     439.     431.     424.     416.     409.     401.
                    394.     387.     380.     373.     366.     360.     353.     347.     341.     335.
```

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.04	18.39	3.65	628978.
										(560.)(467.)(93.)(17810.66)			

1 PART

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

SUBAREA 2 (RESERVOIR) RUNOFF COMPUTATION

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SA-2	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	-1	0.15	0.00	19.60	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	20.00	103.00	116.00	126.00	134.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS 0.822

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

RECESSION DATA

STRTQ= -2.00 QRCSN= 0.00 RTIOR= 1.00

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.04	22.04	0.00	11325.
										(560.)(560.)(0.)(320.69)			

********** ********** ********** ********** **********

COMBINE HYDROGRAPHS

COMBINING HYDROGRAPHS 1 & 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
SA-2C	2	0	0	0	0	1	0	0

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

ROUTING FLOWS THROUGH RESERVOIR

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
RES	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-428.	-1

STAGE	428.00	429.00	430.00	430.10	431.00	432.00	433.00	434.00	435.00
	438.00								

FLOW	0.00	470.00	1328.00	5250.00	6901.00	8819.00	10973.00	13319.00	15836.00
	24295.00								
CAPACITY=	0.	9.	23.	42.	72.	114.	175.	253.	353.	470.
	536.	599.	757.	928.	2173.					
ELEVATION=	406.	408.	410.	412.	414.	416.	418.	420.	422.	424.
	425.	426.	428.	430.	440.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
428.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
435.0	3.1	1.5	605.

PEAK OUTFLOW IS 15184. AT TIME 46.50 HOURS

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

PART 1

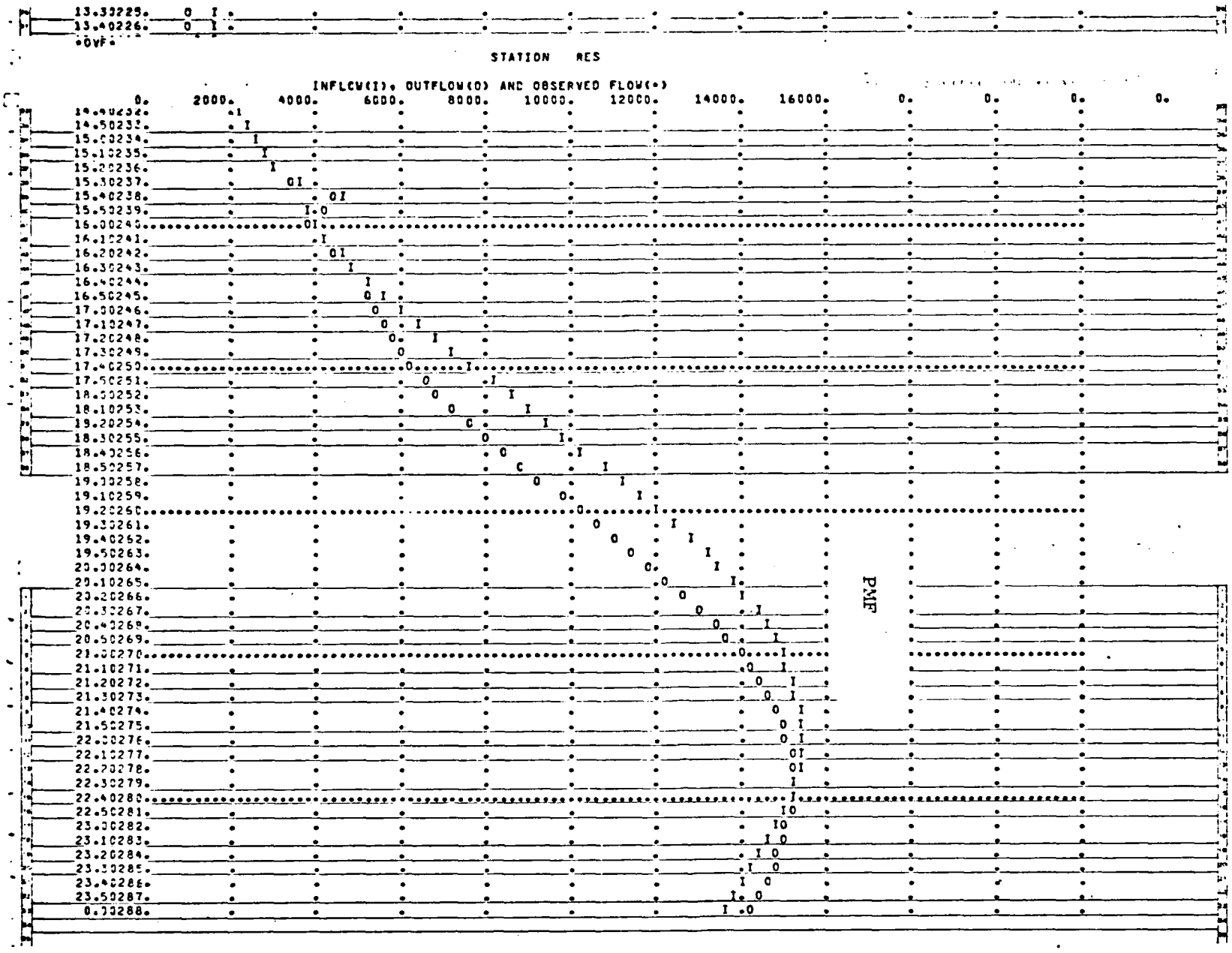
OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 0.50
HYDROGRAPH AT	SA-1	19.47	1	15355.	7678.
		(50.42)		(434.81)	(217.40)
HYDROGRAPH AT	SA-2	0.13	1	1478.	739.
		(0.34)		(41.85)	(20.92)
2 COMBINED	SA-2C	19.60	1	15369.	7685.
		(50.77)		(435.21)	(217.61)
ROUTED TO	RES	19.60	1	15184.	7536.
		(50.77)		(429.95)	(213.40)

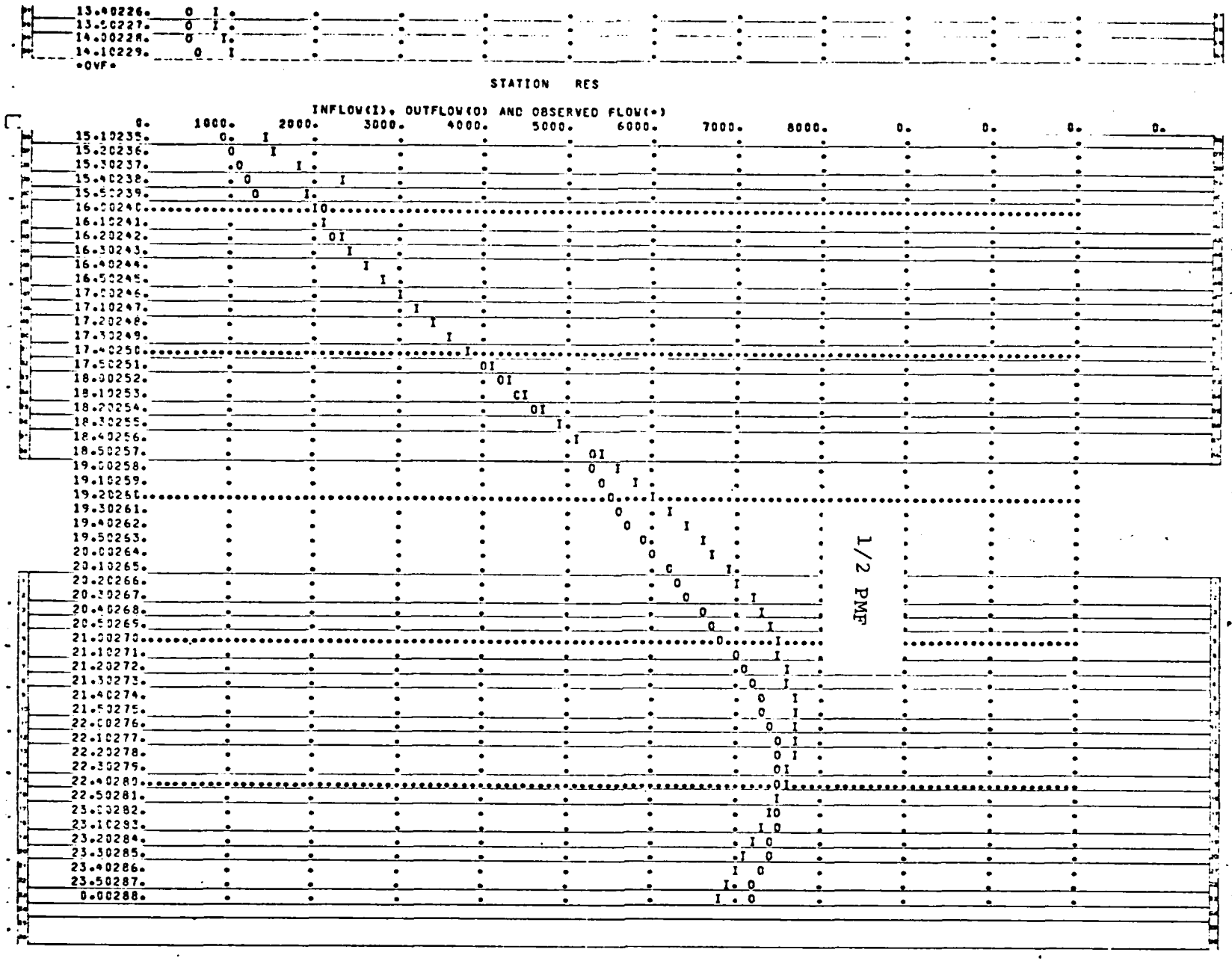
SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	428.00	428.00	435.00
STORAGE	757.	757.	1550.
OUTFLOW	0.	0.	15836.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	434.74	0.00	1518.	15184.	0.00	46.50	0.00
0.50	431.33	0.00	1094.	7536.	0.00	46.67	0.00


STATION RES
INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)
0. 2000. 4000. 6000. 8000. 10000. 12000. 14000. 16000. 0. 0. 0. 0.
PMF
1 PART


STATION RES
INFLOW(I), OUTFLOW(O) AND OBSERVED FLOW(*)
0. 1000. 2000. 3000. 4000. 5000. 6000. 7000. 8000. 0. 0. 0. 0.
1/2 PMF

APPENDIX D

STABILITY ANALYSIS

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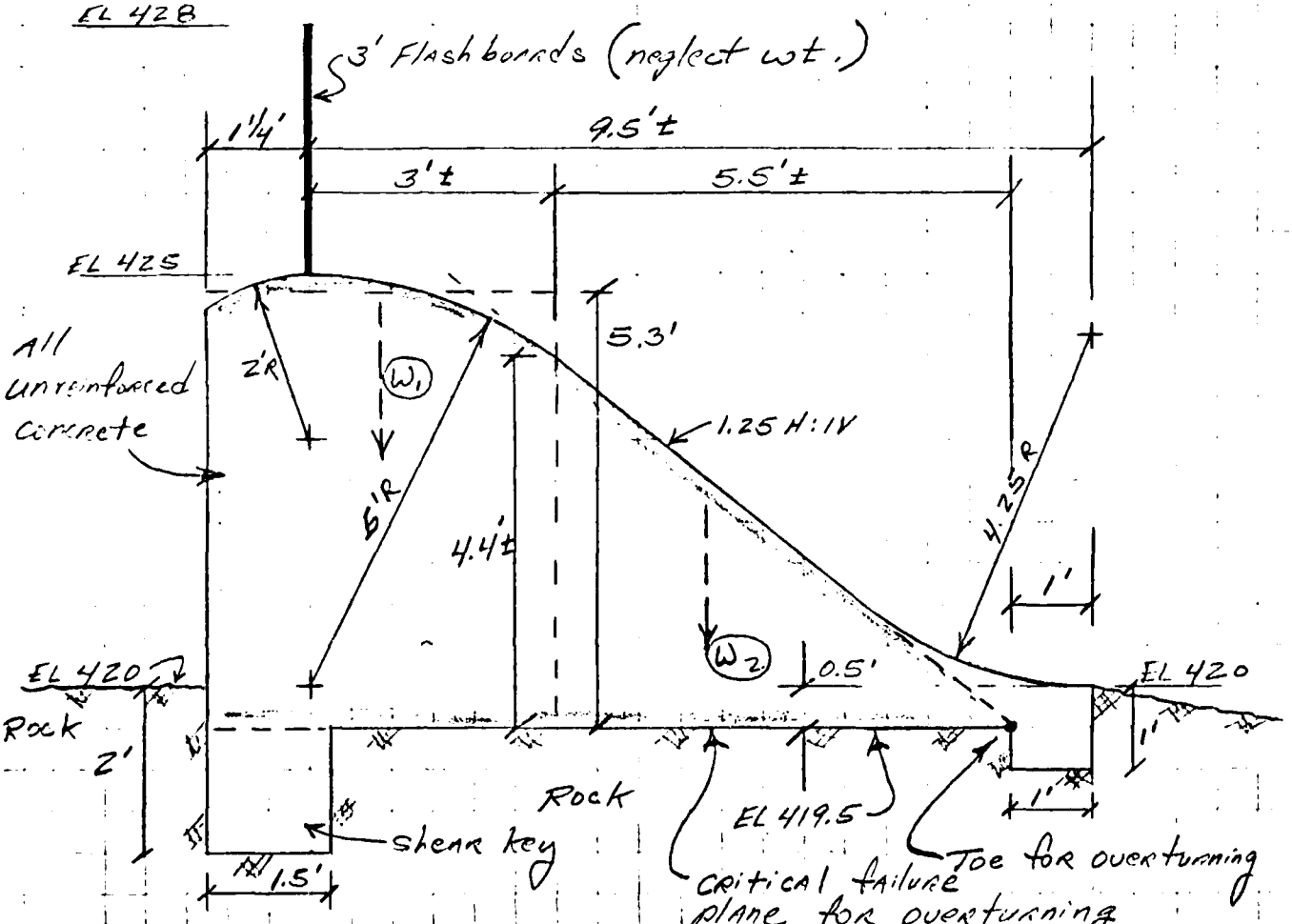
JOB POTIC RESERVOIR DAM
SHEET NO 1 OF 14
CALCULATED BY JMB DATE 5/14/81
CHECKED BY DATE
SCALE 1/4" = 1/2'

STABILITY ANALYSIS OF SPILLWAY

CROSS SECTION FOR ANALYSIS (typical section to left of bend point, see Photos A-7B & A-8B & dwg. Appendix G-3)



Since section unreinforced, wt. & pullout ^ of U/S shear key could not resist overturning w/o cracking concrete at top of shear key. ∴ critical plane for overturning failure is horiz. plane thru U/S shear key at elevation of rock contact at base of structure. Choose toe at extension of d/s face to base.

Form CIM-403A

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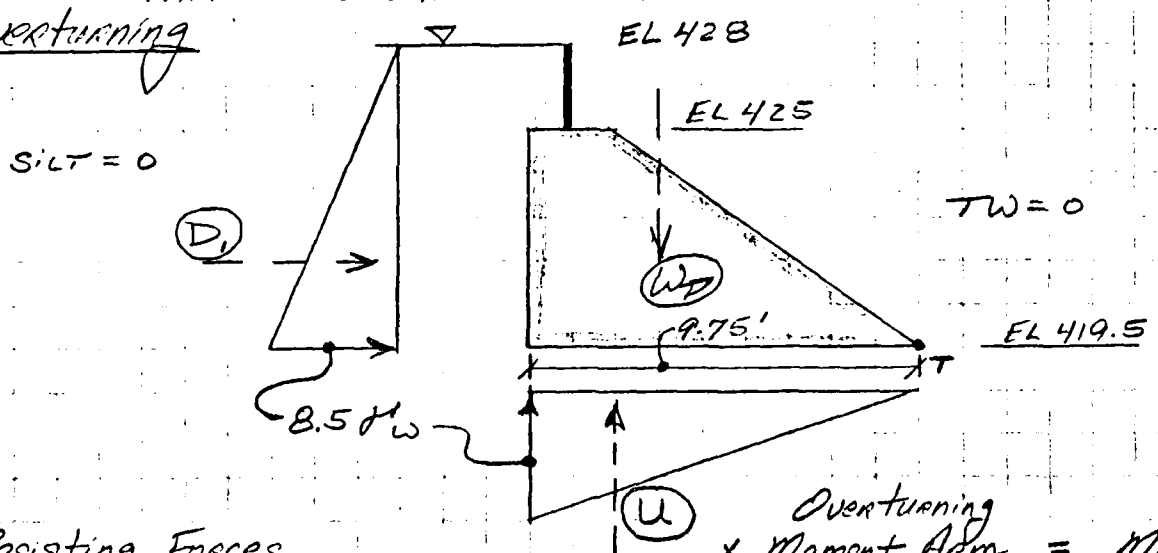
JOB POTIC RESERVOIR DAM
SHEET NO 2 OF 14
CALCULATED BY JPR DATE 5/14/81
CHECKED BY R DATE 6/19/81
SCALE NONE

Dead Load	Volume	× Unit wt(γ)	= W	× Horiz. Moment Arm about toe	= M
W_1	$4'1/4 \times 5.3 \times 1$	0.150 kcf	3.38	$(4.25/2) + 5.5$	= 25.77
W_2	$(5.5/2) \times 4.4 \times 1$	0.150	1.82	$5.5 \times 2/3$	= 6.67
			W_D = 5.20 k		ΣM = 32.44 Ftk

CASE 1 - Normal pool at top of flashboards, full headwater uplift, Assume negligible silt because spillway not in deepest part of res. & spillway not high, negligible tailwater based on observation.

Overturning



Resisting Forces — Overturning Moment Arm = M_R

W_D = dead load = 5.20 k as before — as before — 32.44 Ftk

Driving Forces — Moment Arm = M_D

D_1 = water pressure = $(1/2 \times 8.5 \times 0.0624) 8.5$ = 2.25 k — $8.5/3$ = 6.38

U = headwater uplift = $(1/2 \times 8.5 \times 0.0624) 9.75$ = 2.59 k — $9.75 \times 2/3$ = 16.84

ΣM_D = 23.22 Ftk

$FS = \Sigma M_R / \Sigma M_D = 32.44/23.22 = (1.40)$

Resultant from toe = $d = \Sigma M_T / \Sigma V = \frac{\Sigma M_R - \Sigma M_D}{W_D - U} = \frac{32.44 - 23.22}{5.20 - 2.59}$

$d = \frac{9.22}{2.61} = 3.53' \times \frac{b}{9.75'} = (0.36\,b) > 1/3\,b$

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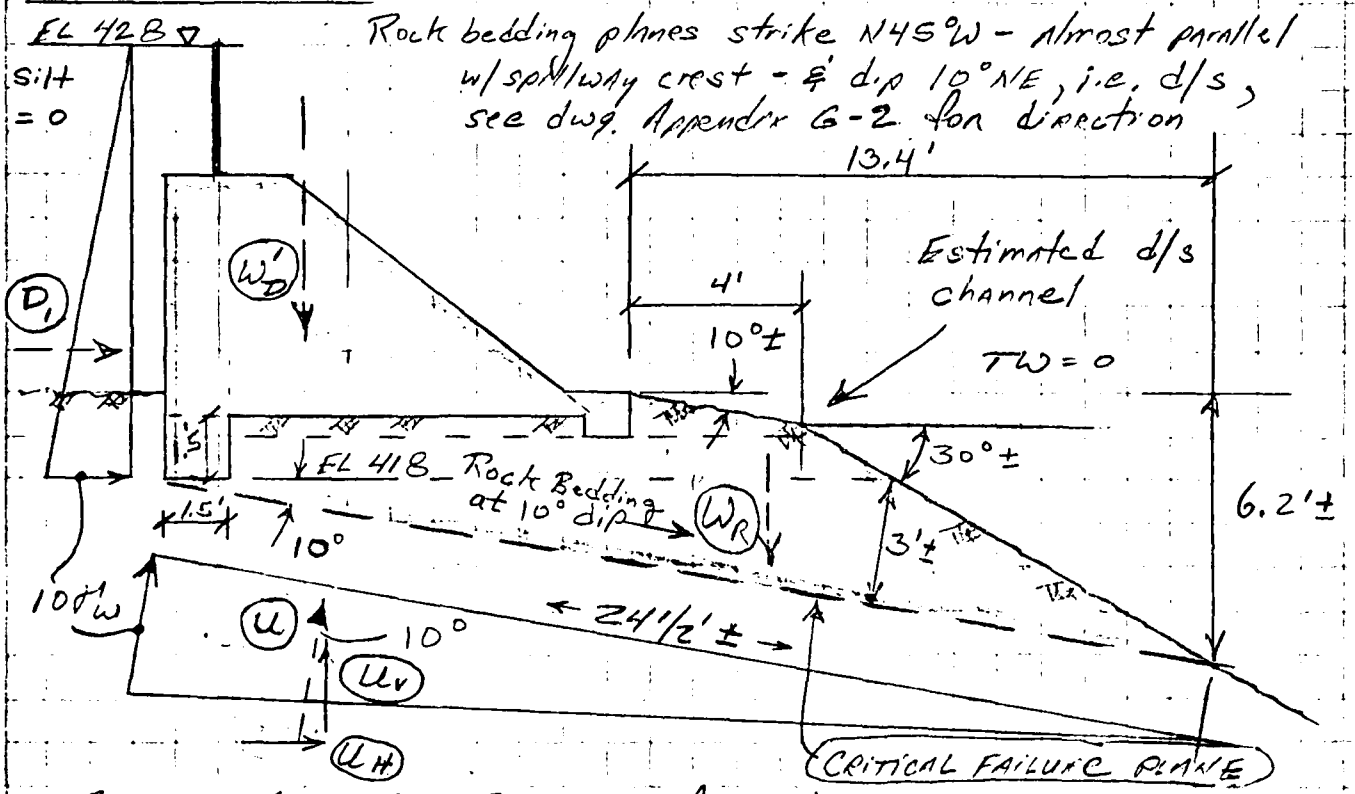
JOB POTIC RESERVOIR DAM
SHEET NO 3 OF 14
CALCULATED BY GMB DATE 5/14/81
CHECKED BY R DATE 6/19/81
SCALE 1/4" = 1'

CASE 1 - SLIDING



Assumed Failure Plane from heel along rock bedding plane at 10° dip d/s until plane daylights.

Horiz. Resisting Force = $R_s = \Sigma V \tan(\phi - \alpha)$ when C = cohesion = 0 where $\alpha = 10°$ (Reference 1)

ϕ = Angle of sliding friction = 40° for the shale or sandstone rock max.

ΣV = summation of vertical forces

W'_D = W_D as before + wt. of two keys

$= 5.20\,k + (1.5 \times 1.5 \times 1 \times 0.150) + (1 \times 1 \times 1 \times 0.150)$

$= 5.20 + 0.34 + 0.15 = 5.69\,k$

$U = 7.64\,k$

$U_V = U \cos 10° = [(1/2 \times 10 \times 0.0624)\,24.5] \cos 10 \cong 7.53\,k$

Vol. Rock $\cong \left[\left(\frac{24.5}{2} \times 3\right) + \left(\frac{15.2 + 13.7}{2} \times 1\right) + (8.8 \times 0.5) + \left(\frac{4.3}{2} \times 1\right)\right] 1$

$\cong 36.75 + 14.45 + 4.4 + 2.15 = 57.75\,ft^3$

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JOB POTIC RESERVOIR DAM
SHEET NO. 4 OF 14
CALCULATED BY JMB DATE 5/14/81
CHECKED BY R 6/19/81 DATE
SCALE None

CASE 1 - SLIDING (Cont'd)

$\gamma_R = 165\ \#/Ft^3$ for the shale or sandstone rock

$W_R = 57.75\ ft^3 \times 0.165\ k/Ft^3 = (9.53\ k)$

$\Sigma V = W_D' + W_R - U_V = 5.69k + 9.53k - 7.53k$
$= 7.69k$

Horiz. Resisting Force

$R_S = \Sigma V \tan(\phi - \alpha) = 7.69 \tan(40-10) = 4.44\ k$

Second Potential Failure Plane thru top of u/s shear key where Resistance = R_S = at least $V_c A$
where A = shear area of u/s concrete key
& V_c = conc. shear strength = $2.0\sqrt{f'_c}$ (ACI Code)
assume $f'_c = 3000$ psi, then $V_c = 2.0\sqrt{3000} = 110$ psi
say $V_c = 100$ psi = 14.4 ksf

Then $R_S = 14.4(1.5 \times 1) = 21.6\ k$ min. due to u/s key

Critical Failure Plane

Since horiz. R_S of dipped bedding plane = 4.44 k
& is << R_S conc. shear key = 21.6 k,

the critical failure plane = dipped bedding plane
& R_S horiz. = 4.44 k.

Horiz. Sliding Forces

D_1 = water pressure = $(1/2 \times 10 \times 0.0624)10 = 3.12\ k$
U_H = horiz. component uplift = $[(1/2 \times 10 \times 0.0624)24.5]\sin 10°$
$= 7.64 \sin 10° = 1.33\ k$
$\Sigma H_s = D_1 + U_H = 3.12 + 1.33 = 4.45\ k$
$FS = R_S/\Sigma H_s = 4.44/4.45 \cong (1.0)$ unstable

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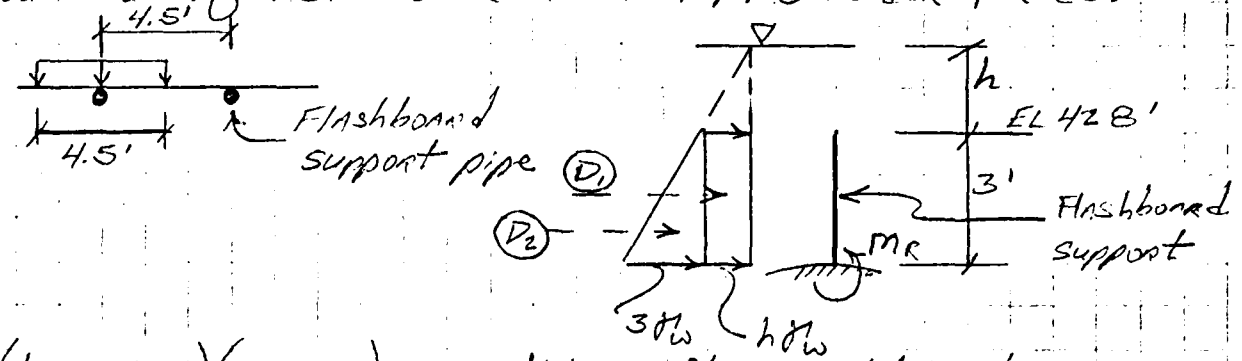
JOB POTIC RESERVOIR DAM
SHEET NO. 5 OF 14
CALCULATED BY GMB DATE 5/15/81
CHECKED BY R 6/19/81 DATE
SCALE None

CASE 2 - Normal pool plus ice load.

Per H&H analysis flashboards are expected to fail at about 2' of head over their top. Consider forces:



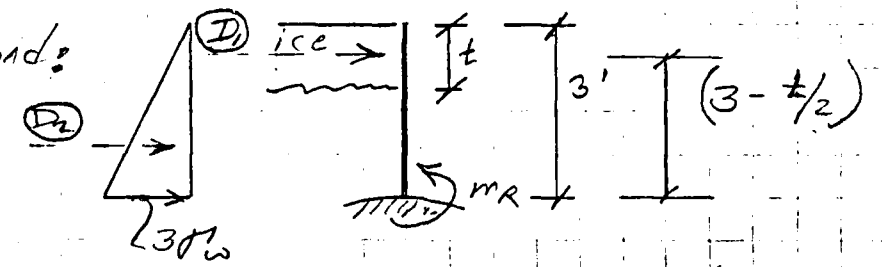
$D_1 = (h \times 0.0624)(3 \times 4.5) = 0.84h$ kips $\times 3/2 = 1.26h$ Ft k

$D_2 = (1/2 \times 3 \times 0.0624)(3 \times 4.5) = 1.26$ kips $\times 3/3 = 1.26$ Ft k

$M_R = 1.26 + 1.26h$ Ft k

For $h = 2'$ of head, $M_R = 1.26 + 1.26(2) = 3.78$ Ft k

For ice load:



$D_1 = (I \times 4.5) \times (3 - t/2) = 4.5I(3 - t/2)$ Ft k

where I = ice load kips/Ft

$D_2 = (1/2 \times 3 \times 0.0624)(3 \times 4.5) = 1.26K \times 3/3 = 1.26$ Ft k

$M_{RI} = 1.26 + 4.5I(3 - t/2)$ Ft k

Reasonable Ice load given the almost 90° Approach from the axis of the reservoir (see dwg. Appendices G-1 & G-2) might be $I = 5$ kips/Ft & $t = 1.0'$

so $M_{RI} = 1.26 + 4.5 \times 5(3 - 1/2) = 1.26 + 56.25 = 57.51$ Ft k

$M_{RI} = 57.21 >> 3.78 = M_R$ due to 2' head

So Assumed ice load would surely fail the flashboards supports, if not the boards themselves.

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JOB POTIC RESERVOIR DAM
SHEET NO 6 OF 14
CALCULATED BY WR DATE 5/15/81
CHECKED BY R DATE 6/19/81
SCALE None

CASE 2 (Cont'd)

What ice load = 2' of head on boards?

M_R water = 3.78 Ft k as before

For ice, Assume $t = 0.5$ nominal

M_R Ice $= 1.26 + 4.5 I\left(3 - \frac{0.5}{2}\right) = 1.26 + 12.38 I$

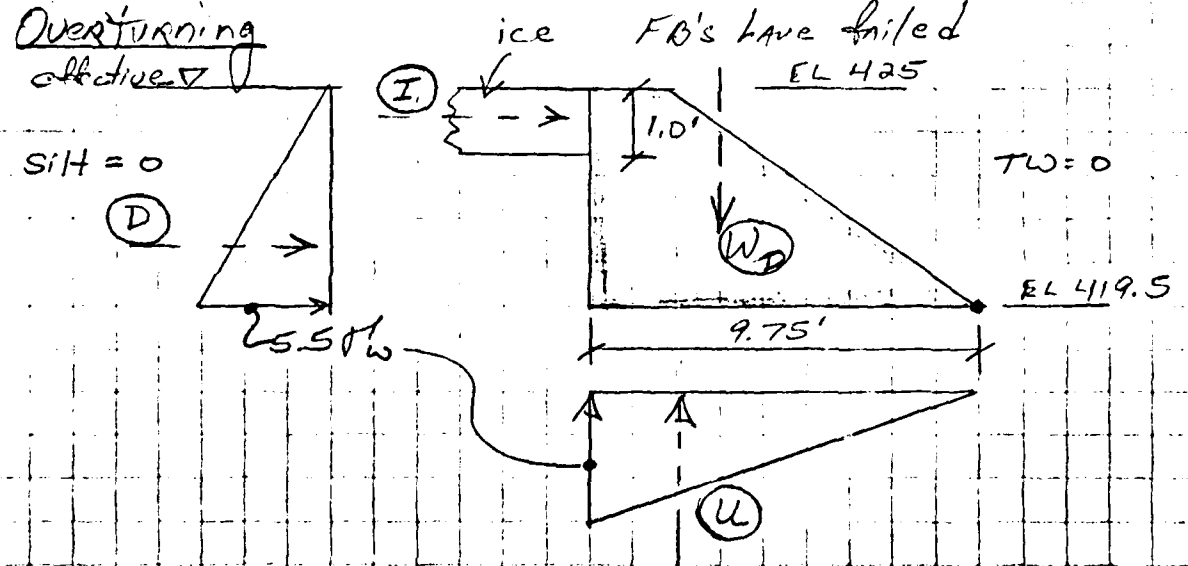
If $1.26 + 12.38 I = 3.78$ Ft k, $I = \frac{2.52}{12.38} = 0.2$ k/Ft

Ice pressure $= 0.2 k/(1' \times 0.5') = 0.4$ ksf <<< 5.0 ksf max. ice press. Reference 1

Assumed ice load of 5K/Ft for 1.0' ice
yields ice pressure $= 5/1 \times 1 = 5.0$ ksf
Max. recommended load per Reference 1
$= 5.0$ ksf $\times$ (1 x 2' thick) $= 10.0$ K/Ft

OK use Ice load = 5.0 K/Ft (1/2 of MAX.) & Assume 1.0 thick
Also, initial ice load shifts boards, pool drops, & ice reforms against conc. spillway.

Overturning



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JOB POTIC RESERVOIR DAM
SHEET NO 7 OF 14
CALCULATED BY MR DATE 5/15/81
CHECKED BY DATE R 6/19/81
SCALE None

CASE 2 - Overturning (cont'd)

Resisting Forces		× Moment Arm =	M_R
W_D = Dead load = 5.20 k as before	×	as before =	32.44 Ft k

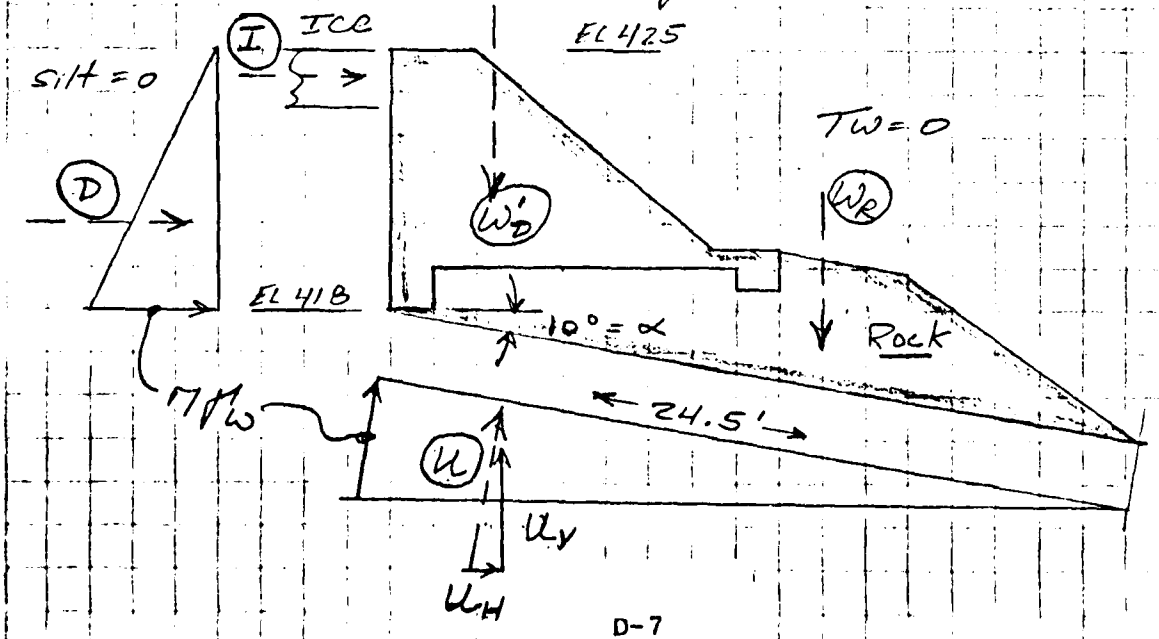
Driving Forces			
I = Ice load = 5 k	× (5.5 − ½)	=	M_D 25.00
D = Water pressure = (½ × 5.5 × 0.0624) 5.5 = 0.94 k	× 5.5/3	=	1.73
U = Headwater uplift = (½ × 5.5 × 0.0624) 9.75 = 1.67 k	× 9.75 × ⅔	=	10.88
		ΣM_D =	37.61 Ft k

$FS = \Sigma M_R / \Sigma M_O = 32.44/37.61 = (0.86) < 1.0$ ... unstable

Resultant from toe = $d = \Sigma M_T / \Sigma V = \frac{\Sigma M_R - \Sigma M_O}{W_D - U} = \frac{32.44 - 37.61}{5.20 - 1.67}$

$d = \frac{-5.17}{3.53} = -1.46' \times \frac{b}{9.75} = (-0.15b)$ unstable

CASE 2 - SLIDING Use same critical failure plane (rock bedding plane) & theory as CASE 1, sheet 3



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JOB POTIC RESERVOIR DAM
SHEET NO 8 OF 14
CALCULATED BY GAB DATE 5/15/81
CHECKED BY DATE R 6/19/81
SCALE None

CASE 2 - SLIDING (Cont'd)

Vertical Forces

W_D' = total dead load = 5.69 k (from Case 1 sliding)
W_R = Wt. of rock = 9.53 k (" " ")
U_V = vert. headwater uplift = $U \cos\alpha = \left(\frac{1}{2} \times 7 \times 0.0624\right) 24.5 \cos 10°$

$= 5.35 \cos 10° = 5.27$ k

$\Sigma V = W_D' + W_R - U_V = 5.69 + 9.53 - 5.27 = 9.95$ k

Horiz. Resisting Force

$R_S = \Sigma V \tan(\phi - \alpha) = 9.95 \tan(40 - 10) = 5.74$ k

Horizontal Sliding Forces

I = ice load = 5 k
D = water press. = $\left(\frac{1}{2} \times 7.0 \times 0.0624\right) 7 = 1.53$ k
U_H = horiz. headwater uplift = $U \sin\alpha = 5.35 \sin 10° = 0.93$ k

$\Sigma H_S = I + D + U_H = 5 + 1.53 + 0.93 = 7.46$ k

$FS = R_S / \Sigma H_S = 5.74 / 7.46 = (0.77) < 1.0$ unstable

CASE 3 - 1/2 PMF pool, no flashboards (expected to fail at 2' of head per H&H analysis), full headwater & tailwater uplift, remainder same as Case 1.

Compute tailwater for flood conditions.

AD-A105 781 MALE (C T) ASSOCIATES SCHENECTADY NY F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. POTIC RESERVOIR DAM (NY 00307)--ETC(U)
AUG 81 K J MALE DACW51-81-C-0014
UNCLASSIFIED NL

2 OF 2
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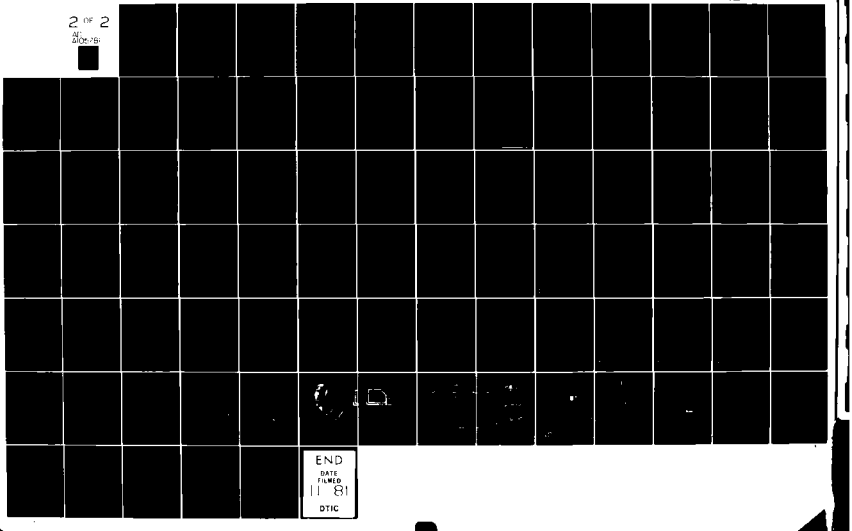

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JOB POTIC RESERVOIR DAM
SHEET NO 9 OF 14
CALCULATED BY MPR DATE 5/13/81
CHECKED BY DATE R 6/19/81
SCALE None R 7/27/81

Tailwater For Flood Conditions

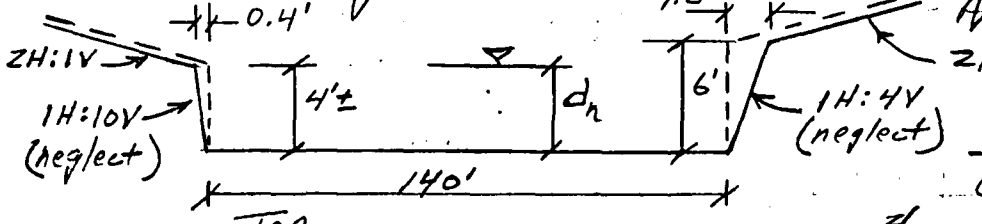
Spillway discharge = Q ≐ 7,500 cfs for 1/2 PMF EL 431.3
≐ 15,200 cfs for Full PMF EL 434.7

Assume uniform flow in spillway discharge channel where:

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ (Mannings equation, Ref. 8)

where n = roughness coefficient ≐ 0.04 for irregular rock channel
A = cross sectional area of flow, Ft²
R = hydraulic radius = A/wetted perimeter (P), Ft
S = slope of energy gradient, assume equal to average slope of channel at ℄, see dwg. Appendix G-2, & G-3, S = (420 − 400)/140'± ≐ 0.14

Average Spillway Discharge Channel X-Sect. (see Sect. C-C on Appendix G-3)



Approximation Looking d/S

$Q = \frac{1.486}{0.04}(0.14)^{1/2} A R^{2/3}$

d	Top Width	A	P	$R^{2/3} = (A/P)^{2/3}$	$Q \doteq 13.90 A R^{2/3}$
1'	140'	140	142	0.99	1926 cfs
2	140	280	144	1.56	6072 cfs ← 1/2 PMF
3	140	420	146	2.03	11851 cfs ← PMF
4	140	560	148	2.44	18993 cfs

By interpolation, for 1/2 PMF Q = 7,500 cfs, $d_n \doteq 2.2'$, say (2')

& for full PMF Q = 15,200 cfs $d_n \doteq 3.5'$ say (3')
(Round down to be conservative for stability)

Form CTM-405 A

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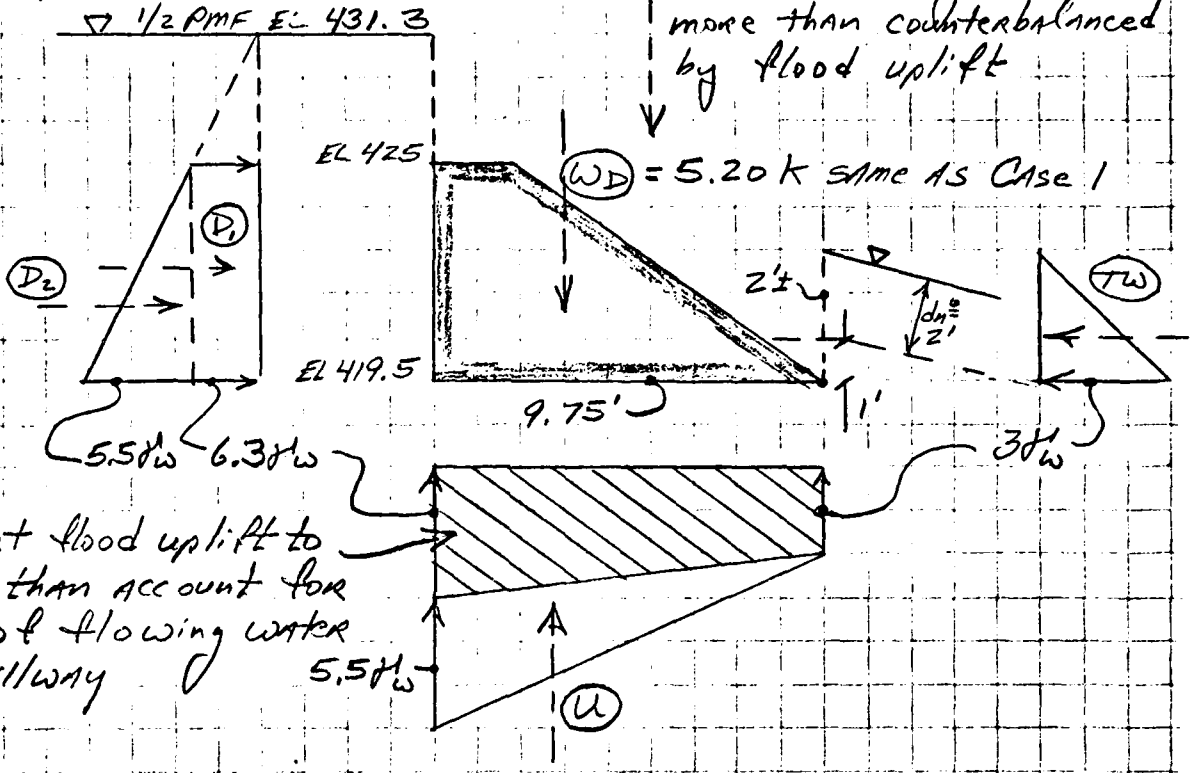
JOB POTIC RESERVOIR DAM
SHEET NO 10 OF 14
CALCULATED BY MMB DATE 6/19/81
CHECKED BY DATE R 7/27/81
SCALE None

CASE 3 - 1/2 PMF OVERTURNING



wt. of flowing water more than counterbalanced by flood uplift

W_D = 5.20 k same as Case 1

neglect flood uplift to more than account for wt. of flowing water on spillway

Resisting Forces	× Moment Arm about toe =	M_R
W_D = 5.20 same as Case 1, sheet 2		= 32.44
TW = flood tailwater = 1/2 × 3 × 0.0624 × 3 = 0.28	× 3/3	= 0.28
		ΣM_R = 32.72

Driving Forces		M_D
D_1 = flood HW pressure = 6.3 × 0.0624 × 5.5 = 2.16	× 5.5/2	= 5.95
D_2 = normal " " = 1/2 × 5.5 × 0.0624 × 5.5 = 0.94	× 5.5/3	= 1.73
U = " HW uplift = 1/2 × 5.5 × 0.0624 × 9.75 = 1.67	× (9.75 × 2/3)	= 10.88
		ΣM_D = 18.56

$FS = \Sigma M_R / \Sigma M_D = 32.72 / 18.56 = \boxed{1.76}$

Resultant from toe = $d = \Sigma M_T / \Sigma V = \frac{32.72 - 18.56}{5.20 - 1.67} = \frac{14.16}{3.53} = 4.01'$

$d = 4.01' \times \frac{b}{9.75'} = \boxed{0.41b} > 1/3\,b$

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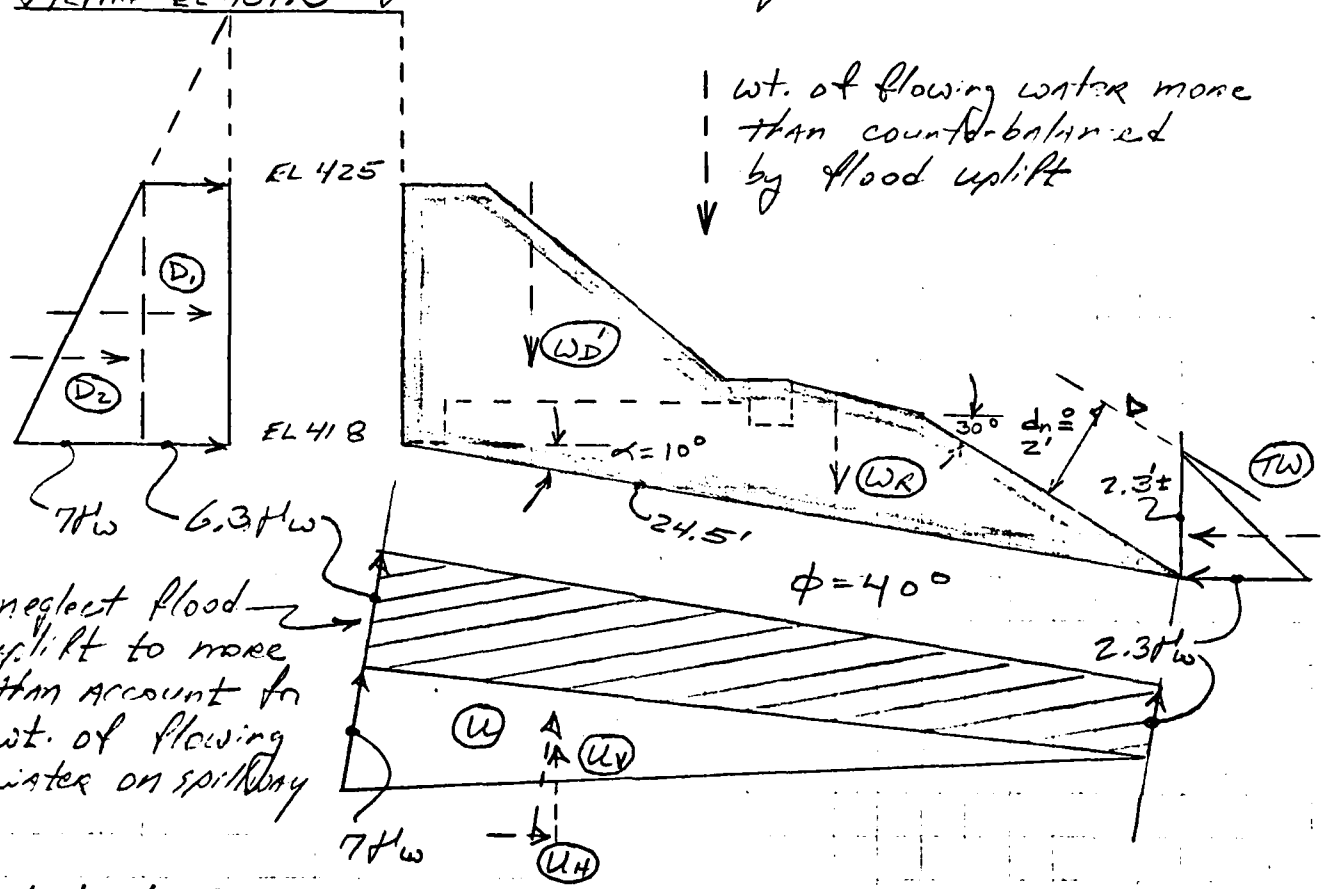
JOB POTIC RESERVOIR DAM
SHEET NO. 11 OF 14
CALCULATED BY JRB DATE 6/22/81
CHECKED BY R DATE 7/27/81
SCALE None

CASE 3 - 1/2 PMF SLIDING - Use same critical failure plane (rock bedding plane) & theory as Case 1.



wt. of flowing water more than counter-balanced by flood uplift

Vertical Forces

W_D' = total dead load = 5.69 k (from Case 1, sheet 3)

W_R = wt. of rock = 9.53 k

U_V = vert. normal HW uplift = $U \cos\alpha = \left(+\frac{1}{2} \times 7 \times 0.0624 \times 24.5\right) \cos 10°$

$= 5.35 \cos 10° = 5.27$ k

$\Sigma V = W_D' + W_R - U_V = 5.69 + 9.53 - 5.27 = 9.95$ k

Horiz. Resisting Force

$R_s = \Sigma V \tan(\phi - \alpha) = 9.95 \tan(40 - 10) = 5.74$ k

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JOB Potic RESERVOIR DAM
SHEET NO 12 OF 14
CALCULATED BY JMB DATE 6/22/81
CHECKED BY R DATE 7/27/81
SCALE None

CASE 3 - 1/2 PMF SLIDING (cont'd)

Horiz. Sliding Forces

D_1 = flood HW pressure = $6.3 \times 0.0624 \times 7 = 2.75$
D_2 = normal " " = $1/2 \times 7 \times 0.0624 \times 7 = 1.53$
U_H = " HW uplift = $U \sin \alpha = 5.35 \sin 10^\circ = 0.93$
TW = flood TW pressure = $\ominus 1/2 \times 2.3 \times 0.0624 \times 2.3 = \ominus 0.17$
$\Sigma H_S = 5.04$

$FS = R_S / \Sigma H_S = 5.74 / 5.04 = (1.14)$

CASE 4 - PMF Overturning - Refer to Case 3, sheet 10 methodology

TW $d_h = 3'$, so $d_V = 3'$ & d_V above toe = 4'

Resisting Forces	× Moment Arm about toe	= M_R
W_D = Same as Case 3, sheet 10		= 32.44
TW = flood tailwater = $1/2 \times 4 \times 0.0624 \times 4 = 0.50$	× 4/3	= 0.67
	ΣM_R =	33.11

Driving Forces		M_D
Normal HW pressure & uplift same as Case 3, sheet 10 = 1.73 + 10.88 →		= 12.61
D_1 = flood HW pressure @ EL 434.7, 9.7' above spillway = $9.7 \times 0.0624 \times 5.5 = 3.33$ k	× 5.5/2	= 9.15
	ΣM_D =	21.76

$FS = \Sigma M_R / \Sigma M_D = \frac{33.11}{21.76} = (1.52)$

Resultant from toe = $d = \frac{\Sigma M_T}{\Sigma V} = \frac{\Sigma M_R - \Sigma M_D}{W_D - U} = \frac{11.35}{3.53}$

$d = 3.22' \times \frac{b}{9.75} = (0.33b) = 1/3\, b$

CT 105

C. T. MALE ASSOCIATES, P.C.
ENGINEERS SURVEYORS ARCHITECTS
LANDSCAPE ARCHITECTS PLANNERS
3000 TROY ROAD, SCHENECTADY, N.Y. 12309
(518) 783-0976

JOB POTTC RESERVOIR DAM
SHEET NO. 13 OF 14
CALCULATED BY JMG DATE 6/20/81
CHECKED BY DATE R 7/27/81
SCALE None

CASE 4 - PMF SLIDING - Refer to Case 3, sheet 11 methodology.

TW d_n = 3', so d_v = 3/cos 30° ≅ 3.5'

Horiz. Resisting Force

$R_s = f(\Sigma V)$. √ Since ΣV same as Case 3, sheet 11,

R_s = 5.74 k

Horiz. Sliding Forces

Normal HW pressure & horiz. normal HW uplift same as Case 3 sheet 11 = 1.53 + 0.93 = 2.46

D_1 = flood HW pressure @ EL 434.7, 9.7' above spillway

= 9.7 × 0.0624 × 7 = → = 4.24

TW = flood TW pressure = ⊖ 1/2 × 3.5 × 0.0624 × 3.5

= ⊖ 0.38

ΣH_s = 6.32

$FS = R_s / \Sigma H_s = 5.74 / 6.32 =$ (0.91) < 1.0

C. T. MALE ASSOCIATES, P.C.
ENGINEERS SURVEYORS ARCHITECTS
LANDSCAPE ARCHITECTS PLANNERS
3000 TROY ROAD, SCHENECTADY, N.Y. 12309
(518) 783-0976

JOB POTIC RESERVOIR DAM
SHEET NO. 14 OF 14
CALCULATED BY JAB DATE 6/23/81
CHECKED BY DATE R 7/27/81
SCALE None

FLOOD OVERTURNING RECONSIDERED - Shape of spillway is like an ideal ogee (although it may not be exact) where pressure of flowing water on spillway ≅ ZERO. Since O/T FS for 1/2 PMF & PMF is >1.5 when full wt. of flowing water taken into account, what is FS when wt. of flowing water completely neglected? Use full normal & flood uplift & full TW pressure.

1/2 PMF OVERTURNING - Refer to Case 3, sheet 10 methodology.

Resisting Forces = same as Case 3 where $\Sigma M_R = 32.72$

Driving Forces	x Moment Arm about toe	= M_D
D_1, D_2 & U_1 = same as Case 3		= 18.56
U_2 = flood TW uplift = $3 \times 0.0624 \times 9.75 = 1.83$	$\times \frac{9.75}{2}$	= 8.90
U_3 = " HW " = $\frac{1}{2} \times (6.3-3.0) \times 0.0624 \times 9.75$		
$= 1.00 \times \left(9.75 \times \frac{2}{3}\right)$	=	6.53
	ΣM_D =	33.99

$FS = \Sigma M_R / \Sigma M_D = 32.72 / 33.99 = (0.96) < 1.0$

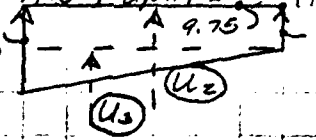
$d = \Sigma M_T / \Sigma V = \frac{32.72 - 33.99}{5.20 - (1.67 + 1.83 + 1.00)} = \frac{-1.27}{0.70}$

$= -1.81 \times 6/9.75 = (-0.19\,b)$

PMF Overturning - Refer to Case 4, sheet 12 methodology.

Resisting Forces = same as Case 4 where $\Sigma M_R = 33.11$

Driving Forces	x Moment arm about toe	= M_D
Normal HW & uplift & flood HW same as Case 3		= 21.76



U_2 = flood TW uplift = $4 \times 0.0624 \times 9.75 = 2.43 \times 9.75/2$ = 11.86

U_3 = " HW " = $\frac{1}{2} \times (9.7-4) \times 0.0624 \times 9.75 = 1.73$

$= 1.73 \times 9.75 \times 2/3$ = 11.27

ΣM_D = 44.89

$FS = \Sigma M_R / \Sigma M_D = \frac{33.11}{44.89} = (0.74) < 1.0$ unstable

APPENDIX E

REFERENCES

POTIC RESERVOIR DAM, NY 00307

PHASE I INSPECTION REPORT

REFERENCES

This is a general list of references pertinent to dam safety investigations. Not all references listed have necessarily been used in this specific report.

1. "Engineering and Design, National Program For Inspection of Non-Federal Dams", ER 1110-2-106, Dept. of the Army, Office of the Chief of Engineers, 26 September 1979, with Change 1 of 24 March 1980. Included as Appendix D of the ER is "Recommended Guidelines For Safety Inspection of Dams".

2. "HEC-1 Flood Hydrograph Package, Users Manual", The Hydrologic Engineering Center, U.S. Army Corps of Engineers, January 1973.

3. "Flood Hydrograph Package (HEC-1), Users Manual for Dam Safety Investigations", The Hydrologic Engineering Center, U.S. Army Corps of Engineers, September 1978.

4. HMR 33, "Seasonal Variations of Probable Maximum Precipitation, East of the 105th Meridian for Areas 10 to 1000 Square Miles and Durations from 6 to 48 Hours," U.S. Dept. of Commerce, NOAA, National Weather Service, 1956.

5. HMR 51, "All-Season Probable Maximum Precipitation, U.S. East of 105th Meridian for Areas from 1000 to 20,000 Square Miles and Durations from 6 to 72 Hours", U.S. Dept. of Commerce, NOAA, National Weather Service, 1974.

6. HYDRO-35, "Five-to-60 Minute Precipitation Frequency for the Eastern and Central United States", U.S. Dept. of Commerce, NOAA, National Weather Service, June 1977.

7. "Technical Paper No. 40, Rainfall Frequency Atlas of the United States", U.S. Dept. of Commerce, Weather Bureau, 1961.

8. Design of Small Dams, United States Dept. of the Interior, Bureau of Reclamation, Second Edition, 1973, Revised Reprint, 1977.

9. King, Horace W. and Brater, Ernest F., Handbook of Hydraulics, fifth edition, McGraw-Hill Book Co., Inc., New York, N. Y., 1963.

10. "Flood Hydrograph Analyses and Computations", EM 1110-2-1405, U.S. Army Corps of Engineers, 31 August 1959.

11. "Technical Release No. 55, Urban Hydrology for Small Watersheds", U.S. Dept. of Agriculture, Soil Conservation Service (Engineering Division), January 1975.

12. National Engineering Handbook, Section 4, Hydrology, U. S. Dept. of Agriculture, Soil Conservation Service, August 1972.

13. "Hydraulic Design of Spillways", EM 1110-2-1603, U.S. Army Corps of Engineers, 31 March 1965, with Change 1 included.

14. "Standard Project Flood Determinations", EM 1110-2-1411, U.S. Army Corps of Engineers, 26 March 1952.

15. "Hydrologic and Hydraulic Assessment", Appendix D of EC 1110-2-188, U.S. Army Corps of Engineers, 30 December 1977.

16. "Reviews of Spillway Adequacy, National Program of Inspection of Non-Federal Dams", ETL 1110-2-234, U.S. Army Corps of Engineers, 10 May 1978.

17. Hammer, Mark J., Water and Waste-Water Technology, John Wiley & Sons, Inc., New York, 1975.

18. "Hydraulic Charts For the Selection of Highway Culverts", Hydraulic Engineering Circular No. 5, U.S. Department of Commerce, Bureau of Public Roads, December 1965.

19. "Guide for Making a Condition Survey of Concrete in Service", American Concrete Institute (ACI) Journal, Proceedings Vol. 65, No. 11, November 1968, pages 905-918.

20. "Lower Hudson River Basin, Hydrologic Flood Routing Model", New York District, Corps of Engineers, January 1977.

21. "Climatological Data, Annual Summary, New York, 1979", Volume 91, No. 13, National Oceanic and Atmospheric Administration, Asheville, North Carolina.

22. "Climatological Data, New York, September 1980", Volume 92, No. 9, National Oceanic and Atmospheric Administration, Asheville, North Carolina.

23. "Water Resources Data For New York, Water Year 1979", Volume 1, USGS Water-Data Report NY-79-1, U.S. Geological Survey, Albany, New York, 1980.

24. "Maximum Known Stages and Discharges of New York Streams Through 1973", Bulletin 72, U.S. Geological Survey, 1976.

25. "Characteristics of New York Lakes (Gazetteer)", Bulletin 68, U.S. Geological Survey and NYS Department of Environmental Conservation, 1970.

26. "Gravity Dam Design", EM 1110-2-2200, U.S. Army Corps of Engineers, 25 September 1958, with Changes 1 & 2 included.

27. "Gravity Dam Design - Stability", ETL 1110-2-184, U.S. Army Corps of Engineers, 25 February 1974.

28. Rich, J.L., "Glacial Geology of the Catskills", New York State Museum Bulletin No. 299, University of the State of N.Y., Albany, N.Y., December 1934.

29. Geologic Map of New York, Hudson-Mohawk Sheet, New York State Museum and Science Service, University of the State of N.Y., State Education Dept., Albany, N.Y., reprinted 1973.

30. "Landforms and Bedrock Geology of New York State", New York State Museum and Science Service, University of the State of N.Y., State Education Dept., Albany, N.Y, reprinted 1973.

APPENDIX F

AVAILABLE ENGINEERING DATA AND RECORDS

TABLE OF CONTENTS

APPENDIX F

SECTION F1

LOCATION OF AVAILABLE ENGINEERING DATA AND RECORDS

1. Owner: Village of Catskill
422 Main Street
Catskill, NY 12414
Attn: Thomas Porto, Supt. of Public Works
518-943-5530

Available: Drawings & letters.

2. Designer: Hazen & Everett, Civil Engineers
25 West 43rd Street
NY, NY (Chester M. Everett)

Believed to now be:
Hazen & Sawyer, P.C.
360 Lexington Ave.
NY, NY 10017 212-986-0033

Not Contacted.

3. Construction Contractor: Unknown.

4. Owner's Present Consulting Engineer:

John D. Rusack, P.C.
285 Main St.
Catskill, NY 12414
Attn: John D. Rusack, P.E., President
518-943-3073

Available: Drawings.

5. Agency: NYS Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233
Attn: George Koch, P.E., Chief, Dam Safety Section
518-457-5557

Available: Specifications, construction application, inspection report.

NYS Department of Health
Northern Region Office
Building 7A
State Office Building Campus
Albany, NY 12226
Attn: David J. Curtis, P.E., Senior Sanitary Engineer
518-457-7150

Available: Catskill Water Supply Report of 1971.

4585

PHASE I INSPECTION

CHECKLIST FOR GENERAL ENGINEERING DATA
& INTERVIEW WITH DAM OWNER

Name of Dam Potic Reservoir Dam Fed. Id.# NY 00307

Date April 9, 81 Interviewer(s) Thomas P. Bennedum

Dam Owner/Representative(s) Interviewed, Title & Phone# Richard "Rip" Clearwater, Water Plant Operator (Been employee 20 yrs.±)
Plant d/s dam - 518-945-1839, Home next to plant (518) 945-2666
(see 9- OTHER)

1. OWNERSHIP (name, title, address & phone #) Village of Catskill,
422 Main St., Catskill, NY 12414
Attn: Joseph Izzo Village President (part time)
Carolyn Stevens, Clerk (full time), 518-943-3830 or 2749

2. OPERATOR (name, title, address & phone # of person responsible for day-to-day operation) Thomas Porto, Supt. of Public Works, address same as Owner, 518-943-5530, &
Richard "Rip" Clearwater, Water Plant Operator, RD Box 20 Earlton, NY 12058, Home next to plant, 518-945-2666

a. Operator Full/Part time Part time, but lives & works Been Water Plant Operator 15 yrs.± 1000'± d/s dam

3. PURPOSE OF DAM

a. Past same as present

b. Present Water supply for Village of Catskill

4. DESIGN DATA

a. Designed When 1930

b. By (name, address, phone #, business status)
Hazen & Everett, Civil Engineers 25 West 43rd. St., NY, NY (Chester M. Everett) Believed to now be Hazen & Sawyer, P.C., 360 Lexington Ave. NY, NY 10017, 212-986-0033

c. Geology Reports None known

d. Subsurface Investigations None known

e. Design Reports/Computations (H&H, stability, seepage)
None known

4591

f. Design Drawings (plans, sections, details) yes - see Appendix G-1 thru G-6

g. Design Specifications yes - see Appendix F3-1 thru F3-38

h. Other n/a

5. CONSTRUCTION HISTORY

a. Initial Construction

1) Completed When About 1930

2) By (name, address, phone #, business status) unknown

Possibly Stone from Board-owned quarries per specs, Appendix F3-7

3) Borrow Sources/Material Tests possible borrow areas identified on design/const. dwg., Appendix G-1, & in specs, Appendix F3-9, mainly reservoir area.

4) Construction Reports/Photos None known

(see OTHER BELOW)

5) Diversion Scheme/Construction Sequence See specs Appendix F3-7 & F3-22. Double barreled diversion conduit built first w/right side becoming piped as permanent outlet conduit. Upstream part of dam.

6) Construction Problems None known

7) As-Built Drawings (plans, sections, details) None known

8) Data on Electrical & Mechanical Equipment Affecting Safe Operation of Dam No electric at the dam. Village furnished gate equipment per specs, Appendix F3-7 & F3-18. See Appendix G-4 for dwg.

9) Other Only permanent plug for left barrel of diversion conduit appears to be 6"x8" oak stop logs bolted together across u/s end of conduit barrel.

4576

b. Modifications (review design data & initial construction items as applicable & describe)

None known

c. Repairs & Maintenance (review design data & initial construction items as applicable & describe) No records.

- 1974 ± minor concrete patching on left T.W. of spillway by Mario Ordirizzi, Catskill, NY (Contractor still in business)
- 1975 ± last time brush cut off of dam.
- 1979 last time grass on crest mowed.

6. OPERATION RECORD

a. Past Inspections (dates, by, authority, results)

Only record of past inspection - Sept. 14, 1972 by NYS-DEC, see Appendix F3-50 (Inventory shows one in 1973)

b. Performance Observations (seepage, erosion, settlement, post-construction surveys, instrumentation & monitoring records) No instrumention. No particular problems noted. Appears to be possible observation well in embankment just to left of spillway. Operator doesn't know what it is.

c. Post-Construction Engineering Studies/Reports 1958-1961, capacity surveys made by Benjamin L. Smith & Associates, see Appendix F3-43 thru F3-46 & G-7 & G-8. (See 9-OTHER)

d. Routine Rainfall, Reservoir Levels & Discharges • W.L. measured on spillway by Operator randomly, daily when water is low, i.e. below flashboards. Readings recorded on daily worksheets for filter plant, but period of record unknown. (height above flashboards)

- 24-hr. rainfall recorded by Operator at filter plant every day at 8AM. Recorded on daily worksheets. Period of record 1965 ± to present. Maybe some prior 1965.
- We did not review records or obtain samples.

4564

e. Past Floods That Threatened Safety (when, cause, discharge, max. pool elevation, any damage)

March 1980 W.L. was 10" above flashboards (highest in last 15 yrs.) Had over 7" rain in 24 hr. @ filter plant gage.

f. Previous Failures (when, cause, describe)

Reportedly all flashboards failed once, but don't know when. No other failures known.

g. Earthquake History (seismic activity in vicinity of dam)

None known

7. VALIDITY OF DESIGN, CONSTRUCTION & OPERATION RECORDS (note any apparent inconsistencies)

- Spillway about 141' long w/ one bend point. Dwgs. show 140' w/ no bend point.
- Dwgs. show flashboard sockets 3' deep. Operator says 4'.
- Dwgs show flashboard supports as 2" xtra strong pipe. Actual supports are 2" pipe w/ 1 1/2" pipe inside, All std galvanized.
- No stop logs noted across intake to gate house as shown on dwgs., Appendix G-4. (See 9- OTHER)

8. OPERATION & MAINTENANCE PROCEDURES

a. Operation Procedures in writing? No Obtain copy or describe. (reservoir regulation plan, normal pool elevation and status of operating facilities, who operates & means of communication to controller, mode of operating facilities, i.e., manual, automatic, remote)

- Flashboards are up all the time. Normal W.L. at flashboard crest. No effort to control W.L. by gate operation.

(see 9-OTHER)

b. Maintenance Procedures in writing? No Obtain copy or describe. • When flashboards fail, even small section, All boards & only damaged pipe supports are replaced.

• Every spring floating debris cleaned off of flashboards. Large debris are removed as req'd at other times.

c. Emergency Action Plan & Warning System in Writing? No
Obtain copy or describe. (actions to be taken to minimize the D/S effects of an emergency)
No thought given to this. Operator feels that he could notify Village Police w/ his truck radio. Village Police could then notify State Police & Sheriff's Dept.

9. OTHER Post-Construction Studies

6c) • Benjamin L. Smith & Associates now Smith & Mahoney Consulting Engineers, 40 Steuben St., Albany, NY 12207 518-463-4107.

(Also Applies To 7) → • November 1971 Water Supply Report, see Appendix F3-47. Operation of the 3-level water intake described doesn't seem to match drawing, Appendix G-4.

8a) Operation Procedures (36"ϕ)

• In gate hse., u/s gate (low level intake or drain) is always closed & is now. It was freed up & operated as a test last year.

• In gate hse., d/s (36"ϕ) valve (outlet conduit intake) is always full open & is now. Outflow controlled by automatic float-operated valve at filter plant. Avg. outflow = 1.5 mgd ≙ 2.3 cfs

• Blowoff gate (24"ϕ gate valve at end of diversion conduit at d/s toe) is always closed. Only used once last year as a test. Valve box is presently removed & valve operating nut is buried. Operator plans to reinstall valve box soon.

• There is no regular or periodic operating or exercising of any of the values.

Persons Interviewed • Previously on March 17, 1981, met & obtained dwgs. & written data from Thomas Porto, Supt. of Public Works & John D. Rusack, P.E., Consulting Engineer, Catskill, NY

APPENDIX F

SECTION F3

COPIES OF ENGINEERING DATA AND RECORDS

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DEC

F3-1

BOARD OF WATER COMMISSIONERS

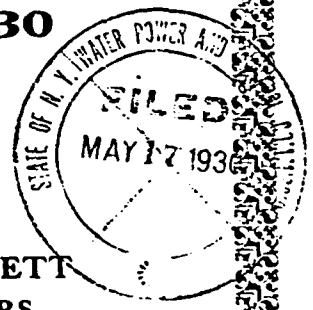
CATSKILL, NEW YORK

DAM AND FILTERS

CONTRACT NO. 2

Specifications, Contract and Bond

April, 1930



HAZEN & EVERETT
CIVIL ENGINEERS
25 West 43rd Street
New York City

DAILY MAIL PRINT

DEC

F3-2

BOARD OF WATER COMMISSIONERS

CATSKILL, NEW YORK

Specifications, Contract and Bond

For

DAM and FILTERS

Contract No. 2

Sealed proposals will be received by the Board of Water Commissioners of the Village of Catskill, until 2 P.M. (East Daylight Saving) o'clock, ... May 26 .. 1930, for the construction of a Dam and Filters.

Specifications, form of proposal, bond and contract may be obtained at the office of the Board of Water Commissioners, and at the office of Hazen & Everett, Consulting Engineers, 25 West 43d Street, New York City.

Certified Check

The proposals shall be accompanied by a certified check, drawn upon an incorporated state or national bank or trust company, in good credit, within this State, payable to the order of the Village of Catskill, for five per cent. of the amount of the bid. A bidder's bond from an approved surety company will be accepted in lieu of the certified check. The checks deposited by the unsuccessful bidders will be returned by the Board of Water Commissioners. A bond in the sum of one hundred per cent of the amount of the contract will be required to be executed by the party to whom the contract is awarded, and by an incorporated surety company duly authorized to do business in this State and to execute the same, both as to form and surety satisfactory to the Board of Water Commissioners of the Village of Catskill, hereinafter referred to as the Board. Bonds shall be negotiated through bonding company representatives who are residents of Catskill.

All bids shall be made on the blank form of proposal annexed hereto, shall give the price for each item of the proposed work, both in writing and in figures, and shall be signed by the bidder, with his business address and place of residence, and in case of firms the name and residence of each and every member of the firm shall be inserted. In case a bid shall be submitted by or in behalf of a corporation, it shall be signed in the name of such corporation, by some duly authorized

officer thereof, who shall also subscribe his own name and title of his office, and, if practicable, the seal of the corporation shall also be affixed.

The checks deposited by unsuccessful bidders will be returned by the Board. The amount of the check deposited by the unsuccessful bidder shall be forfeited in the event that said bidder shall fail within the time set forth to execute the formal contract, and deliver the bond hereinafter required.

The parties to whom the contracts are awarded, will be required to present forthwith to the Board, the name of the surety to be offered and to execute the contract and to furnish the bond duly executed and duly acknowledged, with satisfactory surety, within ten days from the date of mailing notice of the award of the contract to the successful bidder at the business address given in the bid; and in case of failure or neglect to do so will be considered as having abandoned the contract, and the check accompanying the proposal shall be forfeited to and retained by the Village of Catskill as liquidated damages for such neglect or refusal, and the Board shall have power to rescind said award and to re-advertise for proposals and make new awards.

All bids will be compared on the basis of the Engineer's estimate of the quantities of work to be done as follows:

Item 1: Clearing approximately 88 acres.
Item 2: Earth Excavation, including spillway, borrow pits and everything but trench, approximately 53,000 cubic yards.
Item 3: Trench excavation for cutoff wall, approximately 850 cubic yards.
Item 4: Trench excavation for piping, approximately 1,000 cubic yards.
Item 5: Rock excavation, approximately 2,300 cubic yards.
Item 6: Earth fill, approximately 800 cubic yards.
Item 7: Rolled embankment, including core, approximately 52,000 cubic yards.
Item 8: Riprap, approximately 3,000 cubic yards.
Item 9: Paving on slopes, approximately 7,400 square yards.
Item 10: Paving floor of coagulation basin, approximately 4,200 square yards.
Item 11: Fill of crushed stone, including road surfacing, approximately 1,000 cubic yards.
Item 12: Concrete in foundation floors, approximately, 1,260 cubic yards.
Item 13: Concrete in heavy walls, approximately 1,100 cubic yards.
Item 14: All other concrete, approximately 420 cubic yards.
Item 15: Steel reinforcement, approximately 70,000 pounds.

Item 16: Structural steel, approximately 80,000 pounds.
Item 17: Placing cast iron pipe, fittings and gates, approximately 170 tons.
Item 18: Tile drains. Lump sum.
Item 19: Buildings. Lump sum.
Item 20: Stream control. Lump sum.
Item 21: Creuting. Lump sum.
Item 22: Appurtenances. Lump sum.

These quantities are approximate only, being given as a basis for the comparison of bids, and the said Board reserves the right to increase or decrease the amount of any class or portion of the work as may be deemed necessary by the Engineer. The contract will be awarded to the lowest and best responsible bidder, as the Board in its sole judgment may determine, but the Board reserves the right to reject any or all bids, or to accept any bid, should it deem it for the interest of the Village of Catskill to do so.

The work shall be commenced within ten days from the date of mailing of notice to the successful bidder at the busness address given in the bid that the contract and bond have been executed to the satisfaction and approval of the Board, and the work shall be completed on or before December 1, 1930.

WILTON O. EDWARDS,
Clerk of the Board of Water Commissioners of the Village of Catskill.

Date: ..... May 8..., 1930.

DEC

F3-4

BID

PROPOSAL TO THE BOARD OF WATER COMMISSIONERS OF THE VILLAGE OF CATSKILL, FOR DAM AND FILTERS

The undersigned bidder (the term "bidder" is intended to mean the individual, firm or corporation doing the bidding, as the case may be) declares that the bidder is the only person or corporation interested in this proposal, and that no person or corporation other than the bidder herein named has any interest in this proposal or in the contract to be taken, and the bidder further declares that this proposal is made without any connection with any other person or corporation making a proposal for the same, and is in all respect fair and without any collusion or fraud, and that no city officer, or clerk, or member of any city board or body, elected or appointed, is interested directly or indirectly, either as principal or surety, in this proposal or in the contract proposed to be taken, or in the supplies or works to which it relates, or in any portion of the profits thereof; that the bidder is not in arrears to the Board of Water Commissioners of the Village of Catskill, or said Village, upon any obligation to the said Board or Village; also that the bidder has carefully examined the location of the work, and the plans and specifications and form of contract for the work hereto annexed, and the bidder is satisfied from the bidder's own examination as to all matters relating to the work to be performed, and that the bidder will contract to provide all necessary tools, apparatus and implements, and to furnish all the materials and labor necessary for the full and perfect completion of all the work, and all its parts within the time mentioned in the specifications, and as required by, and in accordance with, the contract and specifications hereto annexed, and the requirements of the Engineer as herein set forth and the resolutions of said Board relating thereto, and in accordance with the general plan and description of the materials to be used and the way in which the work is to be done, submitted with the bid and attached hereto, and made part of this bid; and that he will take in payment therefor the following sums, to wit:

CONTRACT NO. 2

Item 1: For clearing, the sum of ..... dollars and ..... cents ($ .....) per acre.

Item 2: For earth excavation, including spillway, borrow pits and everything but trench, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 3: For trench excavation for cutoff wall, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 4: For trench excavation for piping, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 5: For rock excavation, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 6: For earth fill, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 7: For rolled embankment, including core, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 8. For rip rap, the sum of ..... Dollars and ..... cents ($.....) per cubic yard.

Item 9: For paving on slopes, the sum of ..... dollars and ..... cents ($.....) per square yard.

Item 10: For paving floor of coagulation basin, the sum of ..... dollars and ..... cents ($ .....) per square yard.

Item 11: For fill of crushed stone, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 12: For concrete in foundation floors, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 13: For concrete in heavy walls, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 14: For all other concrete, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 15: For steel reinforcement, the sum of ..... dollars and ..... cents ($ .....) per pound.

Item 16: For structural Steel, the sum of ..... dollars and ..... cents ($ .....) per pound.

DEC

F3-5

Item 17: For placing cast iron pipe, fittings and gates, the sum of ..... dollars and ..... cents ($ .....) per ton.

Item 18: For tile drains, the lump sum of .... dollars and ..... cents ($ .....).

Item 19: For buildings, the lump sum of ....dollars and ..... cents ($ .....).

Item 20: For stream control, the lump sum of .... dollars and ..... cents ($ .....).

Item 21: For grouting, the lump sum of .... dollars and ..... cents ($ .....).

Item 22: For appurtenances, the lump sum of .... dollars and .... cents ($ .....).

For extra work or materials, if any, the reasonable cost of the work or materials as agreed or as determined by the Engineer, plus ten (10) per cent. of such cost.

If this proposal shall be accepted by the said Board of Water Commissioners and the undersigned bidder, shall fail to contract as aforesaid, and to give bond in the sum of one hundred per cent. of the amount of the contract, in form and with surety or sureties satisfactory to said Board, within ten days from the date of the award of the contract, then the bidder shall be considered to have abandoned the contract, and the certified check for five per cent. of the amount of the bid accompanying this proposal, shall be forfeited to, and become the property of the Village of Catskill; otherwise the accompanying check shall be returned to the undersigned bidder.

Dated at ..... the ..... day of ..... 1930.

Name .....

P. O. Address .....

.....

STATE OF NEW YORK,

County of .....

.....

being duly sworn, say that .....

.....

that the several matters above stated are, in all respects, true.

.....

Subscribed and sworn to before me, this .

..... day of ..... 1930.

.....

Notary Public

The bidder shall here state what work he has done and give references that will enable the Board to judge of his experience, skill and business standing:

CONTRACT AND SPECIFICATIONS

This agreement, made this ..... day of .....

..... A. D., one thousand nine hundred and thirty, by and between the Village of Catskill, a municipal corporaton created and organized under the laws of the State of New York, acting by and through its Board of Water Commissioners, party of the first part, and

.....

.....

.....

party of the second part, thereinafter designated as the Contractor:

(1) WITNESSETH: That the parties to these presents, each in consideration of the undertaking, promises and agreements on the part of the other herein contained, have undertaken, promised and agreed, and do hereby undertake, promise and agree, the party of the first part for itself, its successors and assigns, and the party of the second part for the contractor and the contractors, heirs, administrators, executors, successors, and assigns, as follows:

(2) The Contractor, in consideration of the sums of money hereinafter mentioned, to be paid to the said Contractor, shall and will, at the Contractor's own cost and expense, furnish all the materials and do all the work called for by this contract, to wit: the furnishing of all labor and materials for the constructing complete and ready for use of a dam, purification plant and appurtenances.

The word "Board" shall mean the Board of Water Commissioners or any person or officer duly authorized by it to act for the Village of Catskill in the execution of the work covered by this contract.

The word "Engineer" shall mean the person duly appointed by, and acting in the capacity of Engineer of the said Board for this work, or his representatives on the ground acting within the scope of the particular duties entrusted to him.

DEC

F3-7

SPECIFICATIONS

Work to Be Done

The work to be done under this Contract consists in the clearing of the reservoir area, the construction of an earth dam, with clay core, concrete cutoff wall and spillway, an open coagulation basin with paved slopes, a mechanical filtration plant, a pure water reservoir, and the pipe connections and appurtenances to connect the various parts.

The Contract is for the doing of all work and the furnishing of material for a complete storage reservoir and purification plant ready for service, except that the pipe, specials, and gates will be furnished to the Contractor by the Board.

Drawings

The entire work and its location are shown on a set of twenty-two (22) plans, dated April 29, 1930, and signed by Chester M. Everett, Engineer.

Material Furnished by the Board

The Board will furnish the cast iron pipe, special castings, gates, Venturi meters, gauges, chemical feed orifice boxes and the controllers as listed in the attached schedules. All other materials are to be furnished by the Contractor.

The materials furnished by the Board will be delivered to the Contractor on board cars at Catskill.

The Contractor shall promptly unload these materials on notice from the Engineer and shall pay all demurrage accruing if not removed within the time limit set by the carrier. Unloading facilities shall be provided by the Contractor and all dock or yard rentals required for the operation of unloading and storing the material shall be paid by him.

The Contractor shall inspect all materials delivered to him at once to make sure they are in good order; shall report all cracked pipe or other defective material and shall allow the same to remain until inspected by the Engineer; shall haul them to the site of the work and store them and shall protect them from loss or damage from any cause until required in the work and shall be responsible for any pipe or material found broken on the work and for all parts lost or damaged after he takes charge of them and shall make good by replacing or repairing such parts. Care shall be taken not to damage the coating of the pipes or the cement lining.

Care of Roads

The Contractor will be required to maintain the public roads in the vicinity of the work in a safe and passable condition and shall at the expiration of the work repair any damage to them which he may have done until they are in as good condition as that in which he found them at the commencement of the work. He shall provide crushed stone and haul and place it wherever in the judgment of the Engineer such fills are needed to restore the roads and all such work

shall be done at his expense and no claim for extra compensation shall be made therefor.

Use of Stone from Quarries Owned by the Board

There are several quarries on land owned by the Board and adjacent to the site of the work. In the working of these quarries large piles of rejected stone have accumulated. Some of this stone is suitable for ballast for the concrete, some for paving and rip-rap and any of it for fills of crushed stone and road surfacing.

The Contractor shall have the right to use any or all of the stone accumulated in these spoil heaps or to quarry new stone as he sees fit to provide material for use under this contract, and no charge will be made by the Board for stone so taken. He may set up a crusher and screening plant to produce crushed stone for ballast for concrete and fill of crushed stone provided, however, that the stone so used shall be selected under the inspection of the Engineer.

GENERAL DESCRIPTION OF THE WORK

The Dam

The dam is to consist of an earthen embankment, with concrete and puddle corewall cut into the bottom and sides, with a masonry culvert through the bottom, and a gate house and outlets for drawing water. An overflow is to be cut on the south bank of the stream at the end of the dam, and the material obtained in excavating the overflow is to be used in building the embankment. The rest of the material for the embankment is to be obtained from borrow pits and from the channel improvement excavation below the dam.

Clearing Reservoir

The whole area to be flooded, and extending to a point three feet vertically above the flow line, is to be cleared and cleaned preparatory to flooding.

Outlet

The general order of constructing the work is to be as follows: The permanent outlet culvert is to be first built, with foundations for the gate house. A substantial coffer dam is to then be built across the present channel of the brook, diverting the flow through the permanent outlet.

The entire site of the dam is to be cleared and grubbed and the soil excavated and piled up for finishing the dam.

Embankment

Upon the foundation thus prepared is to be built an embankment of mixed clay and earth rolled in layers. The material in the middle part of the dam is to be a mixture of clay and earth, and the quality of this material will be rigidly insisted upon. Other parts of the dam may be made of the same material or of any material which can be satisfactorily rolled.

As the embankment proceeds the concrete of the gate house foun-

cation is to be carried up from time to time.

Wasteway Excavation Made First

The excavation for the wasteway is to be made first, and the material used in the body of the dam. Excavation shall be made approximately at the lines and to the dimensions shown, but in case ledge is found to be otherwise than it is now believed to be from the test pits thus far dug, such modifications in the location or design of the wasteway structures shall be made as required by the Engineer.

Minor parts of the work are to be built as convenient in connection with the main work.

When all the work to be done under this contract is otherwise completed, the gates and connecting pipes at the bottom of the gate chamber shall be set in concrete, and made watertight.

The Purification Plant

The coagulation basin will be an open basin constructed by excavating the material from the hillside and forming an embankment by rolling the material in layers. The bottom and interior slopes of this basin will be covered with stone paving made of stones obtained from the quarry spoil heaps and placed by hand. A wood baffle will be constructed through the center of the basin and an aerator built into one corner.

The filters will be of the gravity rapid sand type and will be enclosed in a brick building with the wash water tank, the pumps, chemical dosing apparatus and other appurtenances.

A covered masonry reservoir will be built adjacent to the filters and pipe connections shall be laid from the dam to the coagulation basin and between the basin, filters and pure water reservoir with the necessary drains and subsidiary piping and a connection made with the pipe line being laid under Contract 1.

Some work will be required for the improvement of the stream channel alongside the purification plant, consisting of an enlargement of the channel and protective work to prevent destructive scour.

CLEARING

Item No. 1

Work to Be Done

The Contractor shall clear the entire site of the reservoir and a marginal strip around the same including all land below contour 430, of all perishable materials. The approximate total area is 88 acres, including open land requiring no clearing.

Disposal

The wood cut by the Contractor shall belong to him and may be used or sold by him but in any event shall be entirely removed from the property of the Board or burned. All wooden or wire fences shall be removed or burned.

Trees and Stumps

The Contractor shall clear the entire area of all trees, bushes, logs, stumps, high grass, and weeds, and shall burn these materials. All trees now standing and all stumps shall be cut off so as to leave stumps not over 12 inches high. Decaying stumps shall be grubbed out.

All stumps and large roots between Elevations 422 and 430 the area being about 47 acres, shall be cut out.

Final Clearing

The final clearing of the reservoir shall not be commenced until such time as the Engineer shall direct, about two months before the filling of the reservoir is begun, and shall then proceed at the rate required and shall be thoroughly done. If any aftergrowth of bushes, tall weeds, or grass occurs, the Contractor shall cut and burn them as required for the first growth.

Compensation

Compensation shall be the price bid per acre for clearing the reservoir and shall include all labor and materials for doing the work as above specified.

EARTH EXCAVATION

Item No. 2

Work to Be Done

All excavation shall be done under this item except that in trench or rock. The work shall include the removal of the soil under the area occupied by the Dam, the excavation for the Spillway, the material removed from the borrow pits, the digging for the Coagulation Basin, for the Filter House and the Pure Water Reservoir and the widening of the channel of the river alongside the Purification Plant.

Surface Soil

Surface soil shall be removed and stored for subsequent placing on the top and back of the embankments of the dam and the coagulation basin and for surfacing the hills around the filters and pure water reservoirs.

DEC

F3-9

Clearing

Trees, stumps and brush shall be cleared from the site of the excavation under this item.

Lines

Excavation shall be made for the various structures to the lines, grades and forms shown by the plans or given by the Engineer.

Character of Material

The material to be excavated is a mixture of loam, sand, gravel and boulders with some clay and loose shale.

Disposition of Material

Top soil shall be placed on the upper surface of fills as directed. Excavated material at the dam, spillway and borrow pits shall be used to form the dam. Material excavated for the coagulation basin, filters and pure well shall be used in forming the embankments of the coagulation basin and the fills around the filters and pure well. Material excavated to widen the river channel shall be used for the fills at the purification works or in the dam. Material unsuitable for fills shall be left in neatly graded piles as directed by the Engineer.

Unauthorized Excavation

In case the excavation at any point is carried beyond the lines and grades given by the Engineer, the Contractor shall, at his own expense, refill such unauthorized depth or width of cut with such materials as may be directed for insuring the stability of the various structures. Under all foundations unauthorized excavation shall be refilled with concrete or rolled embankment or such other material as the Engineer shall direct.

Additional Excavation

The plans are intended to show the general character of the work, based on the information now available. If in the progress of the work it should be deemed advisable to extend the excavation or change their locations the Contractor shall make such excavation and receive compensation therefor under this item.

Borrow Pits

All of the clay for the core wall and such extra material for embankments above that found in the excavations for the spillway and river widening shall be taken from borrow pits located on the property of the Board.

The location of possible borrow pits is shown on the plans but the Contractor may use other pits on the property of the Board provided the material in them is accepted as suitable by the Engineer and the location is approved by him.

Excavation in borrow pits will be estimated and paid for under this item.

Drainage

The Contractor shall provide suitable drainage and shall remove all water promptly from all excavations and keep them dry while the work is being prosecuted therein and until its completion. The Contractor shall provide such pumps as are necessary and shall pump out all water from any source that needs to be removed in the course of the work.

Measurement

The quantity of excavation paid for under this item shall be the amount actually removed measured in place before excavation.

Protection of Slopes

The Contractor shall protect the sides of excavation until the completion of the structures to be placed therein and if material slides down it shall be removed without further payment therefor.

Disposal of Boulders

Stones larger than 6 inches in diameter shall not be placed in embankments or fills but shall be placed in fills of riprap or used as paving.

Damage to Abutting Property

The Contractor shall make no excavation outside the lines of the property owned by the Board nor pile any material outside these lines except he obtains permission of the owner of the property affected and does so at his own risk and expense.

Sheeting and Bracing

If sheeting and bracing is required to hold the material in place it shall be provided by the Contractor under this item, and no additional compensation will be paid therefor.

Rock

No rock shall be included in this item. Boulders exceeding one cubic yard will be estimated and paid for as rock and shall be excluded from this item.

Compensation

The price bid per cubic yard for earth excavation shall be compensation for all work and material required to do all excavation, except rock excavation, and trench excavation, to keep it free from water and from caving until the completion of the structures to be constructed therein, and for the disposal of all material not required to make the necessary fill.

TRENCH EXCAVATION FOR CUTOFF WALL

Item No. 3

DEC

Under this item the Contractor shall excavate the trench under the dam for the cutoff wall. This trench shall be carried to rock and all loose rock shall be removed at the surface of the bed rock.

Dimensions

The cutoff wall shall have a minimum thickness of three feet. The Contractor shall excavate a trench sufficiently wide to allow this wall to be placed. If the material will stand without sliding and the Contractor so desires, he may dig a trench 3 feet wide and place the concrete without forms, but in any event the quantity estimated under this item shall be computed on a width of trench equal to three feet and extending from the surface of the ground to the rock regardless of the actual quantity removed.

Borings and Test Pits

The Board has dug test pits and made borings along the approximate line of the trench and this information is available for examination by the Contractor, but the Board does not guarantee that the position of the rock will be exactly as shown by these pits and borings. The Contractor must form his own opinion of the diffficulty of this portion of the work and shall excavate to the rock at whatever depth it may lie.

F3-10

Drainage

The Contractor shall provide and operate pumps of sufficient capacity to remove all water from the trench during excavation, cleaning of the rock surface, grouting and placing of the concrete.

Sheeting and Bracing

Sheeting and bracing shall be provided and placed if required to keep material from sliding into the trench. Such timber shall be left in place if ordered by the Engineer and if so ordered, will be paid for at a price of $40 per 1,000 board feet, but not otherwise.

Rock

Loose rock shall be removed under this item at the price bid for trench excavation. Boulders of one-half cubic yard or over and any material requiring blasting to loosen it will be paid for at an agreed price of $6.00 per cubic yard.

Disposal of Material

Excavated material shall be used in the dam or if unsuitable shall be graded in neat piles as directed by the Engineer.

Backfill

In case a trench wider than 3 feet is excavated by the Contractor he shall have the option of refilling the extra width of trench above 3 feet in concrete, thus obviating the use of forms or if forms are used the space between the concrete and the sides of the trench

shall be filled with clay carefully compacted with pneumatic tampers. Such backfill will not be estimated either as concrete or fill.

Compensation

Compensation shall be the price bid per cubic yard for excavating the trench for the cutoff wall and shall include the removal of the material except rock and the keeping free of water until the concrete has been placed.

TRENCH EXCAVATION FOR PIPING

Item No. 4

Under this item the Contractor shall make all excavation required for the placing of cast iron and tile pipe, specials, and gates.

Measurement

Measurement for excavation under this item shall be to a depth 3 inches below the invert of the pipe and between vertical planes six inches outside the sides of the pipe and extending to the surface of the excavated material provided, however, that material excavated under Item 2 will not be estimated under this item.

Drainage

The Contractor shall provide suitable drainage and shall remove all water promptly from all excavations and keep them dry while the work is being prosecuted therein and until its completion. The Contractor shall provide such pumps as are necessary and shall pump out all water from any source that needs to be removed in the course of the work.

Sheeting & Bracing

Sheeting and bracing shall be provided and placed if required to keep material from sliding into the trench. Such timber shall be left in place if ordered by the Engineer and if so ordered, will be paid for at a price of $40 per 1,000 board feet, but not otherwise.

Rock

Loose rock shall be removed under this item at the price bid for trench excavation. Boulders of one-half cubic yard or over and any material requiring blasting to loosen it will be paid for at an agreed price of $6.00 per cubic yard.

Backfill

After the placing of the pipe in the trench the trench shall be carefully backfilled to the surface of the ground with such an allowance for settlement as the Engineer may direct. The cost of making backfill shall be included in the price bid for excavation under this item.

The space under and around the pipes and to a depth of one foot above them shall be carefully filled with suitable material tamped with a pneumatic tamper or puddled with water if the material is suitable and this is allowed by the Engineer. Trenches under the coagulation

basin shall be backfilled with tamped material up to the level of the ground or to the floor of the basin except where backfill of concrete is required, in which case payment will be made under Item 12.

Compensation

Compensation shall be the price bid per cubic yard for trench excavation for piping and shall include removing all material except rock, keeping the trench free of water, sheeting and bracing and backfill.

ROCK EXCAVATION

Item No. 5

The work to be done under this item is rock excavation in open cut. It will include the excavation of rock for the placing of the culvert through the dam, excavation of rock for the spillway, for the coagulation basin, filter building and pure well and for the channel improvement. It shall not include any excavation of rock for the cut-off wall or in trenches which will be paid for under other items.

Measurement

Measurement of the quantities of rock to be paid for under this item shall be the quantity actually removed measured in place before removal.

Unauthorized Excavation

Rock taken out beyond the lines and grade given by the Engineer will not be estimated under this item except that a reasonable amount of overbreakage will be allowed not to exceed twelve inches in any direction. In case rock is taken out below masonry foundations or outside masonry walls to a greater distance than twelve inches beyond the lines given by the Engineer such spaces shall be refilled at the expense of the Contractor with such material as the Engineer shall direct. Under all foundations concrete shall be used for such refilling.

Boulders

Boulders of one cubic yard or over shall be classed as rock under this item.

Material

The rock is of a kind known as bluestone with layers of softer shale merging in places to shale so soft that it can be excavated without blasting. Only material which must be loosened by blasting shall be classed as rock.

Drainage

Water which flows into or collects in the excavation shall be removed before the placing of any concrete therein and shall not be allowed to impair the soundness of the concrete.

Covering

Adequate covers of steel mats shall be placed over the rock before any blasting is done.

Compensation

Compensation shall be the price bid per cubic yard for all rock excavation except that in trench.

EARTH FILL

Item No. 6

Under this item the contractor shall make all fills of earth which do not require to be rolled. Fills shall be made at the outlet of the culvert under the dam, around the filter building and on the top of the pure well and around its walls.

Lines

Fills shall be carefully shaped to the lines given with smoothly graded surfaces. Measurement shall be the quantity actually placed measured in place after all settlement has taken place. Space occupied by riprap or paving shall not be included under this item.

Top Soil

The top six inches of all fills shall be made with selected top soil taken from excavation and kept separate for this purpose.

Allowance for Settlement

Such allowance for settlement shall be made as the Engineer may direct. Slopes shall be protected from wash and from sliding until the expiration of the work and the effects thereof shall be removed by repairs without extra compensation therefor.

Stones

Stones larger than 6 inches in diameter shall be excluded from fills.

Compensation

Compensation shall be the price bid per cubic yard for all fills which do not require to be rolled.

ROLLED EMBANKMENT

Item No. 7

The work to be done under this item consists in the making of the embankment of the dam including the clay core, the embankment around the coagulation basin, the fill for raising the road, and in general any fill which requires rolling for its proper compacting.

Placing the Embankment for the Dam

As soon as the concrete culvert under the dam has been placed ready for the diversion of the stream and the area under the dam has been stripped that portion of the dam up to elevation 415 which is to serve as a coffer dam to divert the stream shall be placed and rolled. This shall be placed as rapidly as possible to prevent its being washed

out by a sudden flood. The material so placed will be included as a part of the dam and will be paid for under this item but the contractor assumes all responsibilities for its protection and in case it is washed out he shall replace it at his own expense. All provisions as to the making and rolling of the main embankment shall apply also to this portion. After the completion of the coffer dam and the cutoff wall the main embankment shall be placed.

Preparation of the Surface of the Ground

The whole area to be occupied by the embankment shall be stripped of top soil and unsuitable material under Item 2. The surface left after stripping shall be roughened and prepared for the embankment by loosening through plowing or otherwise, as directed.

On the slopes at the sides of the valley steps shall be cut.

Spreading and Rolling

The material which is to form the embankment shall be spread evenly in layers of not more than four inches thick when compacted and rolled with a grooved or banded roller of at least 10 tons weight. The roller shall pass over each portion at least six times.

Before each layer is placed the surface of the fill shall be moistened by sprays until a proper bond can be made with the new layer. The material of each new layer shall also be sprayed if required so that it will compact properly but care shall be taken not to use too much water in so doing.

The material to be used in the embankment shall be selected from the excavation and borrow pits by the Engineer and only that which is suitable shall be used and shall be mixed and placed as directed by him.

In the center of the dam an impervious core shall be formed of a mixture of clay and other suitable material placed in alternate layers and thoroughly mixed together and compacted by the action of the grooved roller.

Special borrow pits shall be opened for the clay at the location shown or at other approved points.

The whole surface of the fill shall be kept as nearly level as possible and all of the embankment brought up at the same rate. In placing the fill against the coffer dam and against the masonry structures the roller shall be used as close as possible to these structures and if it is found impossible to properly compact the material against the masonry by rolling, pneumatic tampers shall be used.

Stone and Boulders

Stones and boulders encountered in the excavation and borrow pits may be brought to the embankment with the earth, but all such stones of 6 inches diameter or over, or any size which would interfere with rolling, shall be carefully separated from the fill and placed as riprap on the upstream side of the dam.

Embankment Around the Coagulation Basin

Embankment for the coagulation basin shall be rolled in layers as specified for the dam, but no core wall will be required.

Preparation of the surface shall be as specified above.

If required, however, the contractor shall bring clay from the borrow pits and mix it with the material obtained from the excavation to render the embankment impervious, but such clay will be paid for at the agreed price of 25 cents per cubic yard measured loose in the trucks.

Top Soil

The final surface of the fills shall be made of a layer of top soil at least six inches in thickness, obtained from excavations and kept separate for this purpose. This material shall be smoothly and carefully graded to the lines given and left in a neat condition for seeding.

Raising the Road

Where the present public road will cross the reservoir it shall be raised by the placing of a rolled embankment up to elevation 432 of the dimensions shown. Material for this fill shall be obtained from borrow pits on land belonging to the Board and adjacent to the fill at a distance of less than 1,000 feet, or the Contractor may at his option use rock spoil from the quarries. The top surface of this fill shall be finished with crushed stone under item 11.

A culvert pipe of cast iron, 48 inches in diameter, shall be placed under the road at the location of the present brook.

A wooden fence to the detail shown shall be placed at each side of the road across the fill and shall receive two coats of approved white paint.

Riprap shall be placed on the slopes as required.

The Board reserves the right to change the location of the road where it is to be raised to lessen the height of the embankment. Excavation for such relocated road shall be done and paid for under Items 2 and 5 and fills under this item.

Measurement

Measurement of the quantity of fill under this item shall be made to the lines of the finished surfaces with deductions for riprap, paving, fill of crushed stone, and masonry structures.

RIP RAP

Item No. 8

Riprap composed of durable stones of acceptable sizes shall be furnished and placed to the required thickness on the faces of the dam, on the outside face of the embankment around the coagulation basin, and on the slopes of the dike created by raising the road. Acceptable rock fragments and boulders may be used either from the material excavated, from the spoil heaps in the quarries or elsewhere as the Contractor may elect. Surfaces of riprap shall be roughly trimmed to the required slopes with a moderate amount of rearrangement of the surface stones. Riprap along the bottom of the slopes of the coagulation basin where it would be subject to scour from the stream shall be of selected large stones, which those exceeding ½ cubic yard shall constitute at least 50 per cent of the volume and none smaller than 1 cubic foot.

Stone fill in cribwork shall be classed as riprap and paid for under this item.

Compensation

Compensation for riprap shall be the price bid per cubic yard for riprap measured in place and shall include the procuring, hauling and placing.

PAVING ON SLOPES

Item No. 9

Stone paving shall be placed on the upstream face of the dam above the riprap, on the inside slopes of the coagulation basin, on the slopes of the excavation above the spillway and any other points required. Material for paving shall be stones obtained in excavation or from the quarries and shall be not less than 6 inches in diameter.

Placing

The stones in the paving shall be laid on their edges, with faces to approximately true surfaces, carefully placed by hand, and with spaces between and below filled with smaller stone and spalls driven in, so that the surface will not be easily displaced by frost or ice.

Measurement

No stones shall be used in the paving having a less width than 6 inches, and the average thickness of the paving shall be at least 8 inches. In computing the volume of materials below the paving, a thickness of 8 inches will be allowed for the paving in all cases, and all material below will be otherwise classified.

Compensation

Compensation for paving shall be the price bid per square yard, and shall include all labor and materials required in securing and placing the paving as herein specified to an average depth of 8 inches.

PAVING FLOOR OF COAGULATION BASIN

Item No. 10

The floor of the coagulation basin shall be paved with large flat stones obtained from the quarry. Such stones shall be at least 2½ inches in thickness and not less than one square foot in area each. The top face of each stone shall be approximately a smooth plane and all shall be laid to a true grade with joints having openings averaging not over one inch in width.

After the paving is in place cement grout of one part cement to two parts sand shall be poured into all joints until they are completely filled and then thoroughly brushed in with a coarse broom, leaving a fairly smooth floor.

Compensation

Compensation shall be the price bid per square yard for paving placed and grouted as specified.

FILL OF CRUSHED STONE

Item No. 11

Fills of crushed stone shall be made for a base under the paving on slopes and for surfacing the road into the filter house and on the dike where the road is raised.

For this purpose the Contractor may use the stone from the spoil heaps at the quarry crushed and screened to size.

Size

For the fill under the paving stones up to 2½ inches in size may be used with all material less than ¼ inch in size excluded.

Road Surfacing

After the grade has been prepared stones at least six inches in diameter shall be placed making a base averaging 4 inches thick. These stones shall be placed compactly to form a rough pavement and shall be well rolled.

Wherever the sub-surface has not previously been rolled it shall be rolled preparatory to making this pavement.

On top of this base shall be placed broken stone, graded so that no stone is over 2½ inches in diameter, and the top shall be finished with at least 1 inch of fine screened material. Suitable gravel, if found, may be substituted for the broken stone.

Rolling

The different layers shall be rolled with a roller herein specified for use in rolled embankments, but without the grooves, and it shall pass over the road a sufficient number of times to thoroughly compact the material, and leave the surface smooth and hard and equal in all respects to a macadamized road.

Compensation

Compensation shall be the price bid for fills of crushed stone and shall include the placing and rolling of road surfaces.

CONCRETE

Items Nos. 12, 13, and 14

Item 12: Concrete in Foundations

This concrete shall include that in the cutoff wall, fill around pipes, and all floors and foundations laid on the sub-grade without the use of an underform.

It shall be mixed in the proportions of:
1 barrel American Portland Cement weighing 367 pounds net.
9 cubic feet of sand measured loosely.
16 cubic feet of ballast measured loosely.
(1.4 barrels cement per cubic yard)

Item 13: Concrete in Heavy Walls

This concrete shall include all that in walls 14 inches thick and over except the cutoff wall under the dam which will be included in Item 12.

It shall be mixed in the proportions of:
1 barrel American Portland Cement weighing 367 pounds net.
9 cubic feet of sand measured loosely.
16 cubic feet of ballast measured loosely.
(1.4 barrels cement per cubic yard)

Item 14: All Other Concrete

This concrete shall include all except foundations in the filters, filter building, pure water reservoir, and in general all that not included under Items 12 and 13.

It shall be mixed in the proportions of:
1 barrel American Portland Cement weighing 367 pounds net.
8 cubic feet of sand measured loosely.
14 cubic feet of ballast measured loosely.
(1.6 barrels cement per cubic yard)

To all concrete under this item there shall be added Celite in the proportions of three pounds per bag of cement.

Cement

The Portland cement shall be made by a manufacturer of established reputation, and shall conform to standard specifications of the American Society for Testing Materials. The brand shall be subject to the approval of the Engineer, and only one brand shall be allowed upon the work, except by special permission of the Engineer.

Packing

The cement shall be furnished in bags of strong close duck cloth or paper, and shall, in all cases, be in original packages, suitably branded.

Storing

Cement shall be stored in a suitable house provided by the Contractor for the purpose, near the concrete mixer or mixers. The house shall be sufficiently large so that the different lots of cement shall be kept separately and readily accessible, and no cement shall be used that has not been in the storehouse for two weeks. Scales shall be provided and bags of cement shall be weighed as directed by the Engineer. The total number of bags weighed shall not exceed two per cent. of the total number received, unless the average weight falls short or there is a material variation in the weights of the different bags.

Records

The Contractor shall keep a record of the dates and quantities of the various lots of cement received and of the cement used, and said record shall be accessible to the Engineer at all times.

Quality

The cement shall be of a uniform color, finely ground, so that not more than eight per cent. by weight shall remain upon a sieve with 100 meshes per lineal inch, and shall have a specific gravity not less than 3.10. It shall contain not more than 2.00 per cent. of sulphuric acid, computed as SO3, nor more than four per cent. of magnesia (MGO).

Tests

Round pats of neat cement, about three inches in diameter, one-half inch thick at the center, and tapering to a thin edge, shall not show signs of distortion, cracking, checking, disintegrating, or any other signs of unsoundness after being in the air or water at ordinary temperatures for twenty-eight days, or exposed after setting to an atmosphere of steam above boiling water in a loosely closed vessel for five hours.

Briquettes

Briquettes of cement, with one square inch of cross section, shall develop the following ultimate tensile strengths, as determined from an average of five specimens.

Age, 24 hours, in moist air, strength, 170 pounds.
Age, 7 days (1 day in air, 6 in water), strength, 450 pounds.
Age, 28 days (1 day in air, 27 in water), strength, 550 pounds.
One part of cement to three parts standard sand by weight:
Age, 7 days (1 day in air, 6 in water), strength, 200 pounds.
Age, 28 days (1 day in air, 27 in water), strength, 300 pounds.

Rejection

If any lot of cement, as determined by a reasonable number of samples, fails to pass the tests or is otherwise unsuitable for use in the work, the entire lot from which the samples were taken shall be rejected and immediately removed from the work.

Sand

The sand shall be graded from fine to coarse, and passing when dry a screen having ¼-inch diameter holes, and not more than 30 per cent. by weight shall pass a sieve having 50 meshes per lineal inch. It shall be clean and free from soft particles, lumps of clay, vegetable loam or other organic matter. No sand shall be used not setting up promptly and making satisfactory briquettes with the cement that is used, as strong as the briquettes made with the same cement and standard sand.

Ballast

Ballast shall consist of gravel or broken stone or a mixture of gravel and broken stone. All ballast shall be hard, durable stone. The ballast shall be of such sizes that all will pass through a 2½ inch ring and from which all particles smaller than ¼ inch shall have been screened out. For portions of the work with thin section finer aggregates shall be used as required. Materials shall be well graded from fine to coarse within the above limits, and that which is all of one size shall not be used. It shall be small enough to produce with the mortar a homogenous concrete of sluggish consistency which will pass readily between and easily surround the reinforcement and fill all parts of the forms. Ballast shall be free from dust, loam, clay, ashes or other improper substances. It shall be washed or screened or both if necessary to remove such substances.

The Contractor may crush and screen bluestone from the quarries on the land belonging to the Board and adjacent to the work, and this material will be accepted as ballast for the concrete; provided, however, that only the hard, sound bluestone shall be used for this purpose, carefully selected under the inspection of the Engineer.

Samples

Samples of sand and ballast which the Contractor proposes to use shall be submitted to the Engineer for examination at least seven days before the Contractor commences to deliver the materials upon the ground. Materials shall not be delivered until the samples have been approved by the Engineer, and, as delivered, they shall be in all respects equal to the samples submitted and approved.

Changing Proportions

The Engineer may change the proportions of sand and of the ballast in the concrete, at his discretion, keeping the aggregate volume to be mixed with one barrel of cement unchanged; and he may take into account any small and tolerably uniform quantity of ballast in the sand or any small and tolerably uniform quantity of sand in the ballast, and may change the proportions as may be necessary to correct for such mixing. In case sand is contained in the ballast the volume of it shall be estimated and the quantity of sand shall be reduced, but without corresponding increase in the quantity of ballast, as it is assumed that the sand fills the voids in the ballast and does not increase its total volume. For the purpose of this calculation all material less than ¼-inch shall be considered as sand.

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Mixing

The concrete shall be mixed in machine mixers of approved form, in which materials are mixed in batches, and measuring boxes or other approved apparatus shall be used so that the proportions can be easily and exactly determined. The materials shall be mixed wet enough to produce a concrete of such a consistency as will flow sluggishly into the forms and about the metal reinforcement when used, and which, at the same time, can be conveyed from the mixer to the forms without separation of the coarse aggregate from the mortar. The quantity of water is of the greatest importance in securing concrete of maximum strength and density; too much water is as objectionable as too little. The control of the amount of water in the mix shall be exact and certain. The mixing shall be thorough and shall be continued until every particle of ballast is completely covered by the cement and the mortar uniformly distributed throughout the ballast, and for at least two minutes after all the ingredients are assembled in the mixer. Provisions for removing the concrete from the mixer and for transportation shall be made so that the concrete shall be in place in the condition above specified and before the initial set commences.

Slump Tests

The consistency of the concrete will be determined by slump tests, made as follows:

The sample of concrete to be tested may be taken from the mixer, chute, buggy or from the form being filled, as the engineer may decide.

A truncated cone 12 inches high, 4 inches in diameter at the top and 8 inches at the bottom, made of sheet metal, resting on a smooth, horizontal surface, shall be filled with concrete in 3 layers of approximately 4 inches each. Each layer shall be rodded 30 times, with a 5-8-inch pointed metal rod. When the cone is level full it shall be immediately and carefully removed.

The slump is the distance from the top of the concrete before raising it to the top of the slumped concrete.

In the concrete for this work, the slump shall fall between 2 and 4 inches, except that the engineer may vary these limits, or make other limits for particular parts of the work.

Placing

All concrete after the completion of the mixing shall be conveyed rapidly to the place of final deposit; under no circumstances shall concrete be used that has partly set.

Concrete shall be deposited in such a manner as will permit the most thorough compacting such as can be obtained by working with a straight shovel or slicing tool kept moving up and down until all ingredients are in their proper place. Special care shall be exercised to prevent the formation of laitance; where laitance has formed it shall be removed, since it lacks strength and prevents a proper bond in concrete.

Preliminaries

Before depositing concrete, the reinforcement shall be carefully placed in accordance with the plans. It is essential that adequate means be provided to hold it in its proper position until the concrete has been deposited and compacted; care shall be taken that the forms are substantial and thoroughly wetted (except in freezing weather) or oiled, and the space to be occupied by the concrete shall be free from debris. When the placing of the concrete is suspended, all necessary grooves for joining future work shall be made before the concrete has set. In general, the whole work will be cast in blocks with definite joints, and each block shall be completed before work for the day stops. In any other case that may arise, when work is resumed, concrete previously placed shall be roughened, cleansed of foreign material and laitance, thoroughly wetted and then slushed with one inch of mortar consisting of one part Portland cement and two parts of sand.

Tamping

The operation of tamping shall be so conducted as to give a thoroughly compacted, dense, impervious artificial stone of high specific gravity. Great care shall be taken to remove the air near the forms. This shall be done by thoroughly churning the concrete after it has been deposited in the forms. Forks, spades or other suitable implements shall be used for this purpose. These implements shall also be carefully pushed under all pipes in the forms and along all faces of the walls, in order that there shall be no voids left in the concrete.

Care of Surfaces

All exposed surfaces of finished and unfinished work shall be kept continuously moist by covering or by sprinkling at short intervals, or both, and this moistening shall be continued until the permanent covering or backing is in place. The tops of walls and other surfaces permanently exposed shall be thus protected for a period of one week. Fresh work shall be protected from rain by covering with canvass or other suitable material. Over the roof vaulting a thin layer of earth shall be placed as soon as possible, and the vaulting shall be moistened daily after the heat of the day, until this earth covering is placed, and afterward the soil shall be occasionally sprinkled to keep it moist until the full fill is placed. Concrete shall not be laid in water, nor shall water be allowed to flow over it before it has thoroughly set. No concrete shall be worked over or walked on or in any way disturbed until thoroughly set to the satisfaction of the Engineer.

Grooves in Joints

Grooves shall be formed in general wherever joints occur in the concrete. In walls, grooves shall be formed in all joints and such grooves shall in general be three times as wide as deep and with a slight batter, but the dimensions shall be subject to change by the Engineer on particular parts of the work.

Forms

Forms shall be provided for all parts of the work. They shall be

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substantial and unyielding, in order that the concrete may conform to the design and be sufficiently tight to prevent the leakage of mortar.

Removing Forms

It is vitally important to allow sufficient time for the proper hardening of the concrete, which shall be determined by careful inspection before the forms are removed. Many conditions affect the hardening of concrete, and the proper time for the removal of the forms shall be determined by a competent and responsible person.

Floors

Concrete floors and foundations for walls shall be placed on the ground as excavated, or on the top of the fill, and shall be brought exactly to the required dimensions. The upper surface of the concrete floors shall be finished smooth and impervious to water and free from the appearance of stone.

Forms for Walls

The forms for all walls, unless otherwise specified, shall be of lumber-planed on one side and two edges. The lumber shall be tongued and grooved, or one edge shall be slightly beveled. If lumber with beveled edge is used this beveled edge shall be placed against the straight edge of the next plank and driven to form a tight joint with an even surface. All forms shall be clean and of a smooth surface. Wires, bolts or iron bands to hold the forms may be used in the walls. They shall be neatly cut off after the work is finished, flush with the face of the walls, and the surface left with a neat and presentable appearance.

Placing Walls

The footing shall be thoroughly cleaned and wet, and covered with one inch of soft cement mortar immediately before concrete is placed. The concrete in each block shall be placed in six-inch layers and thoroughly tamped and churned, and each layer shall be placed before the preceding layer has set, so as to make the blocks monolithic. The mixing and tamping of the concrete shall be such that sides of the walls shall be perfectly smooth and free from voids.

Hand holes for cleaning the foundation for the wall shall be left in the bottom part of the wall forms.

Pipe in Walls

Where pipes pass through the walls care shall be taken to bring the concrete into good contact with the pipe, particularly around and underneath all joints and flanges and to have the forms tight around the pipe to secure watertight masonry.

Copper Expansion Joints

Copper strips shall be placed in the joints of the floor and walls of the pure well as shown on sheet No. 20. This copper will be paid for under Item 22.

Steel Plates in Joint Under Walls

Strips of mild steel, one-quarter inch thick and six inches wide, shall be placed in the joint between the floor and wall of the filter boxes and pure water reservoir as shown on Sheets Nos. 14, 19, 20. The steel used will be estimated as steel reinforcing and paid for under Item 15. All other expense connected with placing this steel in the joints shall be included in the unit price per cubic yard bid for the concrete.

Waterproofing

The interior surface of the walls and floor of the pure water reservoir and the filter boxes shall receive two coats of Minwax Heavy clear water-proofing or other preparation satisfactory to the Engineer. Before the waterproofing is applied, the surface of the concrete shall be made satisfactory to the Engineer.

The Minwax water-proofing, or its equivalent will be paid for under Item 22.

Test

After the completion of the masonry and all necessary pipes, gates and drains, and before the fill around the walls is made the Contractor shall test the filters, reservoir, and regulator chambers for leakage. This test shall be made by bringing water to the normal flow line of the structures and noting whether this level is maintained. The test of the filters shall be made before any sand is placed. All leaks shall then be repaired, and the structures again tested until they are substantially tight.

The water for the test will be furnished by the Village of Catskill from the raw water line.

Rubbing

The surface of all concrete to be permanently exposed outside, and that inside the building on walls and ceilings shall be rubbed to a smooth even surface with carborundum brick immediately after the forms are removed. The rubbing shall continue until all the form marks are obliterated.

Finished Floors

All concrete floors in the building shall be neatly troweled to a finish equal to the best sidewalk finish. The surface shall be obtained by floating mortar to the top of the concrete when this is placed. The application of a finish coat of mortar after the concrete has set will not be allowed nor shall the top surface be made extra rich by the addition of neat cement during the operating of troweling.

Compensation

The price bid per cubic yard for each class of concrete shall be compensation for all work and materials (excepting as otherwise provided) including forms all as herein specified protected and delivered at the completion of the work in good order.

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STEEL REINFORCEMENT

Item No. 15

Steel

The Contractor shall provide and place steel rods and steel plates in the concrete, as shown on plans or as required by the Engineer.

Quality

The steel shall be of full dimensions shown and shall be accurately spaced and placed, and shall conform to standard specifications for mild steel having a tensile strength of 55,000 to 65,000 pounds per square inch, and an elongation of at least 25 per cent. and shall stand bending cold 180 degrees to a diameter equal to the nominal size of the rod without cracking. Twisted rods with one complete turn in a length of not less than eight nor more than twelve times the nominal size of the rod, or other approved forms of reinforcing shall be used. The rods shall be free from rust when placed in the concrete.

Placing

The rods shall be held accurately in place by wiring and otherwise during the placing of the concrete. Where the rods cross construction joints, holes or slots in the forms shall be provided, and the space in such a slot not filled by the rod shall be covered by strong tar paper or other adequate support, so that a perfect joint may be formed.

Splicing

As far as practicable, rods shall be of the length shown. Where it shall be necessary to join rods, they shall in general be hooked together by bending at least 6 inches at the end of the rods through an angle of at least 100 degrees and securely binding the rods together with No. 7 wire, Brown & Sharp gauge, or by lapping for 40 diameters. Such joints shall be staggered.

Steel Plates in Expansion Joints

The steel plates in the expansion joints shall be paid for under this item.

Compensation

Compensation for steel in concrete shall be the price bid per pound for the number of pounds actually placed, in accordance with the plans, or as ordered by the Engineer, and shall include the cost of metal, cutting, placing, fastening in position, keeping free from rust, and all other costs connected therewith. It shall not include any waste metal due to the fact that the lengths supplied were too long for their purpose. The quantity paid for shall, however, include extra metal in laps and hooks where authorized by the Engineer due to the fact that a single rod would have been unreasonably long. In computing the weight, one cubic inch of steel shall be reckoned as 0.283 pounds.

STRUCTURAL STEEL

Item No. 16

Under this item the Contractor shall furnish and place all steel I beams, channels, angles, tee bars, flats and rounds, ladders, hangers, brackets, floor plates, gratings, pipe supports, screens, etc., and in general all material composed of structural steel, whether fabricated or not.

All structural steel shown on the plans shall come under this item and also all additional brackets, hangers, and structural shapes which may be required in the structures to be built.

Compensation

Compensation shall be the price per pound bid for structural steel furnished and placed.

PLACING CAST IRON PIPES AND GATES

Item No. 17

The Board will furnish the cast iron pipe and specials, the Venturi meters, sluice gates and valves except those with screw ends. The appurtenances except the gate operating mechanism under Item 22, will also be furnished. An approximate schedule of the material which will be furnished by the Board is shown at the end of these specifications.

Care of Materials

The materials described above will be delivered to the Contractor on board cars at Catskill. The Contractor shall promptly unload these materials on notice from the Engineer and shall pay to the railroad all demurrage accruing if not removed within 48 hours after such notice by the Engineer; shall inspect them to make sure that they are in good order; shall report all cracked pipe or other defective material and shall allow the same to remain until inspected by the Engineer; shall haul them to the site of the work and shall protect them from loss or damage from any cause until required in the work, and shall be responsible for any pipe found broken on the work and for all parts lost or damaged after he takes charge of them, and shall make good by replacing or repairing such parts. All materials shall be handled so as not to damage paint or coating.

Laying

Proper and suitable tools and appliances for the safe and convenient handling and laying of all pipes shall be used. Great care shall be taken to prevent the pipe coating from being damaged, particularly on the inside of the pipes. The pipes shall be thoroughly cleaned before being laid, and when laid shall conform to the lines and grades given by the Engineer. Each length of pipe shall be laid upon blocking, two blocks being provided when required for each length. The blocking shall be of sound planks three inches thick, ten inches

wide, and of a length equal to the diameter of the pipe. Wedges 12 inches long, of 4 x 4 inch, shall be placed on the blocking to hold the pipe in position. The blocks shall be bedded level across the bottom of the trench, and when any block has been sunk too deep, additional blocking shall be placed to bring the pipe to the required grade.

Joints

For the lead joints the spigots shall be adjusted in the bells so as to give a uniform space for the joint, which shall be made with twisted or braided hemp packing and soft pig lead. The packing shall be thoroughly driven into the bells so as to leave a space for the lead at least two inches in depth. The melting pot shall be kept near the joint to be poured, and dross shall not be allowed to accumulate in the pot. The joint shall be thoroughly caulked by competent machanics, the caulking to be done in such a manner as to secure a tight joint without overstraining the iron of the bell. Leadite will be accepted as an alternate to lead for pipes in trench.

Pipes in Concrete Wall

Where cast iron pipes pass through masonry walls they shall be built into and carefully surrounded by concrete where shown, or as ordered, and lead joints shall be made within two feet of the exterior face of the walls. The piping will be laid out as far as practicable to bring joints within this distance, but where necessary, pipes shall be cut to make lead joints in these positions.

Lead and Gaskets

The Contractor shall furnish the bolts and gaskets for making flange joints. All flange pipe and flange gates will be ordered with holes drilled to correspond. The Contractor shall furnish lead for lead joints and all other materials for performing the work. The Contractor shall cut all pipe that may be necessary in a manner satisfactory to the Engineer.

Valves Smaller Than 4 Inches

Only valves 4 in. or more in diameter will be furnished by the Board. All other valves and cocks shall be furnished by the Contractor. All valves with screwed ends shall be furnished by the Contractor.

Gate Boxes

Gate boxes will be furnished with all gates which are to be set in the ground. They shall be carefully set in place.

Tests

The Contractor shall test all pipe lines and make the pipes tight under a pressure of 100 lbs. per square inch.

The Board will provide the water but the Contractor shall provide the pumps, plugs and connections required.

Cover

The pipes shall be laid with a minimum cover of 4 feet except as otherwise shown.

Creek Crossing

The 16-inch main will cross the creek twice. This work may be done while the reservoir is being filled and no flow exists in the stream. Concrete will be used to backfill the trench. Payment for concrete will be under Item 12 and trench under Item 4. All other costs will come under this Item.

Compensation

The price bid per ton shall be compensation for receiving, storing and placing the cast iron pipe, cast iron specials, gates, special valves and Venturi meter and their appurtenances. It shall include placing the aerator piping and the main collectors in the filters. All excavation and backfill shall be paid for under Items 2 and 4.

TILE DRAINS

Item No. 18

The Contractor shall furnish and place various lines of tile pipe about the filters as shown on the plans.

Quality

All pipe shall be of the best quality, sound, hard burned, salt-glazed, vitrified clay of uniform texture acceptable to the Engineer in every respect. All dimensions shall confrom to the standards of the A. S. T. M. for double strength pipe.

Pipes and specials shall be free from blisters, flaws and all defects, and shall in all cases have smooth, hard, even surfaces, especially on the interior.

Inspection

All pipes and specials shall be subject to such inspection and tests on delivery as the Engineer shall require, and shall be subject to his approval or rejection, and all rejected or damaged pieces shall be removed immediately from the work and replaced by such as are acceptable to the Engineer.

Joints

All joints shall be made watertight by first using a small jute gasket thoroughly saturated with neat Portland cement, carefully coiled and placed in the bell of the pipe. The joints shall then be made of Portland cement mortar of one part of cement and one part of clean, sharp sand. The mortar, after being pressed into the joint by hand, shall present a beveled surface, the outer edge of which shall be flush with the bell of the pipe. The joints shall be carefully and thoroughly swabbed on the inside as soon as made.

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Manholes

The Contractor shall have the option of building the manholes of concrete, of the quality specified in Item 14, or of brick laid in Portland cement mortar, the volume being estimated in either case as concrete, and additional cost, if any, is covered by this item.

Kept Clean

All drains shall be cleaned and kept free from all dirt, cement, superfluous materials and obstructions as the work proceeds, and the Contractor shall make good any defects before the acceptance of the work.

Compensation

Compensation shall be the lump sum price bid. Excavation of trenches (including backfill) is paid for as trench excavation.

BUILDINGS

Item No. 19

Under this item the Contractor shall furnish and place all material required for the construction of the filter building and the gate house at the dam. Concrete, reinforcing steel, structural steel, piping and gates and the appurtenances which are listed will be paid for under other items. All other material shall be furnished and work done under this item for the construction of the building complete in every particular.

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Brick Work

This shall include face brick and common brick.

Face brick shall be the brick known as Maple Tone, furnished in a full range of ten shades, as sold by the Willard Brick Company, 110 East 23d Street, New York, or other brick satisfactory to the Engineer.

Samples of the above brick may be seen at the office of the Engineers.

Face brick shall be used for all outer exposed brick up to the elevation 423.25, and for all brick both inside and outside, above elevation 423.25.

For the common brick work, good hard-burned North River brick or equal shall be used.

Brick shall be of standard size, with true surfaces, even, sharp corners and free from imperfections. No brick shall be allowed on the site of the work which have not received the approval of the Engineer.

Mortar

Brick shall be laid in mortar consisting of one part of Portland Cement and three parts of clean, hard sand with the addition of three pounds of Celite per bag of cement. Lime may be added to the mortar in the proportion of 10% of the cement used. All mortar shall be used within four hours of the time it is made.

Laying

Brick shall be thoroughly dampened before being laid. No brick shall be laid in freezing weather. Brickwork shall be well bonded, tied in every sixth course, and worked in regular bond with full flushed joints, leaving no interstices.

Brick shall be laid in a line front and rear, plumb, true, straight and level, conforming accurately to the dimensions and forms shown on the plans.

All windows and door frames, sills, lintels, cornices, structural steel, anchors, woodblocks, pipes, flashing, etc., that are necessary shall be built in as the work proceeds.

All walls shall be properly covered during the progress of the work, and after completion shall be thoroughly cleaned.

Doors and Windows and Trim

Doors, windows and trim shall be furnished and placed as shown on the plans.

Outside doors shall be Lupton's Seamless Tube Doors, set in Lupton Steel Channel frames, with steel saddles. There shall be four of these, with sizes as follows:

That for the main entrance shall be 3 ft. 0 in. x 7 ft. 0 in., and for the other three, 3 ft. 0 in. x 7 ft. 0 in.

Above the door to the chemical room there shall be double shutters with frame, all of pine. These shutters shall fit closely around the trolley support.

All outside doors shall be equipped with solid bronze hardware, hinges and locks. The four entrance doors shall have five tumbler mortise cylinder locks, Yale or equal. The same key shall fit all. The door to the chemical room and the shutters shall have appropriate inside fastener.

There shall be a door provided to the chlorine room and one to the wash room. These shall be pine doors set in a substantial frame and provided with hinges and lock.

Window sash and frames shall be of clear pine and shall be made and set as shown. Windows and doors shall be fully glazed, with Grade A window glass, well bedded in putty and held in place with glazing points. Windows shall be provided with suitable catches of solid brass and necessary pulleys, cord, and counter weights.

Wood Trim

Wood cornices and trim of clear pine around the doors and windows shall be provided and carefully secured to nailing blocks set into the brick.

Sills and Lintels

Cement sills and lintels shall be provided as shown on the drawings, and steel lintels shall be provided as required.

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Partition for Chlorine Room

A partition shall be provided as shown on Sheet No. 11. This shall be formed of 4 inch Gypsum block with two coats of plaster on each side.

The Gypsum block shall be laid in cement mortar as specified for brick work.

The plaster work shall be two-coat work. The proportions of mixing shall be as follows:

Scratch Coat

8 cu. ft. hydrated lime
1½ cubic ft. Portland cement
15½ cu. ft. sand

Finish Coat

Finishing hydrated lime, or freshly burned quick lime, properly slaked and gaged with calcined gypsum. The lime shall pass through a sieve with not less than 10 meshes per inch.

Each coat must be perfectly dried before the next is applied. All lime must be used as soon as it is stiff enough to be worked and must not be allowed to set up in the bed. The first coat shall be placed with sufficient force to insure a good clinch and brought to a true and even surface with sharp corners and left sufficiently rough so that the finish coat will adhere to it. The finish coat shall be trowelled to a burnished, even surface, free from cracks or defects or discolorations. No raw material shall be run on and finished with gaged stuff.

The partition shall be provided with a hollow steel baseboard inside and outside.

Stairs

All floors and stairs are shown on the plans as concrete, and are to be paid for under Item 14. Stairs shall have smoothly rounded corners and all floors and tread shall be trowelled smooth and equal to the best sidewalk work.

Steel Stairs

The Contractor may substitute stairs of pressed steel with cement filled treads for the concrete stairs shown. If this substitution is made the stairs will be paid for as concrete under Item 14, estimating the amount of concrete required in the design shown. Steel stairs must be of a design approved by the Engineer.

Roofs

The roof of the filter house shall be water-proofed with Johns-Manville Standard Asbestos Built-up Roofing, or Barrett Specification Type AA Roof furnished and placed in accordance with the manufacturer's specifications. The roofing shall be placed by men satisfactory to the Company supplying the materials.

The roof water-proofing shall be extended up to the face of the brick wall and under the cast stone parapet.

A 20-year guarantee shall be furnished with this roof.

The roof of the gate house shall be of approved slate with copper flashing.

Roof Drainage

A fill of cinder concrete shall be placed on top of the roof slab to provide a drainage slope. The cinder concrete shall be made of clean, screened steam boiler cinders, mixed in the proportion of eight parts of cinders to one of cement. The upper surface shall be finished off with a mortar top ¾ inch thick and mixed in the proportion of one part of cement to three parts of sand.

A four inch downspout of W. S. pipe shall be placed as shown, and equipped with a Type I Holt Roof Strainer or equal.

Chimney

The chimney shall be built as shown. It shall have one 12 x 12 in. vitrified tile flue and 8 in. brick walls. It shall be provided with the necessary thimbles and cleanouts. The chimney shall be flashed with 16 oz. copper at the elevation of the top of the brick parapet wall, and the roof waterproofing shall be brought up between this flashing and the chimney and made tight.

Cast Stone Copings, Sills and Lintels

A cast stone coping shall be provided for the parapet wall and a cap for the chimney as shown. Cast stone sills and lintels shall also be provided for the windows, and for the stone trim around the rear entrance. These may be cast in place, or cast in sections on the ground and afterwards placed. All surfaces shall be smooth and true with clean, sharp corners and entirely free from voids. Plastering defects will not be allowed. Defective pieces shall be replaced with new ones. Pieces which are not true in shape or dimension or other than pure white, or are without sharp corners and intersections shall be considered to be defective.

The proportions of mixing shall be:

1 barrel Medusa White Cement, weighing 376 pounds net
6 cubic feet of white sand
11 cubic feet of ballast
(2.0 barrels cement per cubic yard)

White cement and sand and suitable fine aggregate shall be used.

The Contractor at his option may use artificial stone of approved manufacture for all the trim of the building. The cost of this trim shall be included in the lump sum bid under this item.

Exterior Wood Trim

The Contractor shall furnish and place under this item the wood trim over the entrance and the cornice with all flashing as shown on Sheet No. 18. The wood shall be clear, sound pine free from knots, holes or defects.

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Structural Steel in Filter Building

The top floor of the filter building shall be supported on steel I beams and columns. All connections in this work shall be made with rivets, not bolts. The Contractor shall submit in advance, details of the connections which he proposes to use for the approval of the Engineer.

Electrical Work

The Contractor shall place a complete electric lighting system with all wiring, conduits, fixtures, switches and cabinets required or shown. The wiring system shall be designed for single phase current at 110 volts but the Board reserves the right to use direct current if alternating current is not available. All material used shall bear the stamp of approval of the Underwriter's Laboratory and all work shall be done in conformity to the Code of the National Board of Fire Underwriters. All wiring inside the building shall be of rubber covered wire installed in concealed conduits of steel.

The Board will bring the wires to the outside of the building. This Contractor shall place the exterior wiring supports on the building, shall bring them through the wall and shall place the main panel and switches with the meters of the Company which supplies the power. All of this work shall be satisfactory to the inspectors of the Power Company.

Lighting Fixtures

All lighting fixtures shall be R. L. M. Reflectors as manufactured by the Holophase Glass Company or others approved by the Engineer. Each shall be equipped with a 110 volt Mazda Type C lamp of the size indicated. Switches for controlling the lights shall be located as shown. They shall be of the push button or snap tumbler type. Three point switches shall be furnished and placed where shown.

Feeder for Hoist

A motor driven hoist shall be placed on the top floor under Item 22. It will have a motor of 1 H. P. A feeder shall be run to top floor for this motor with a switch on the wall and a long flexible cord for attachment to the hoist.

Painting

All exterior wooden trim shall receive 3 coats of approved lead and oil paint of an ivory color. All interior trim shall receive the same except that the color shall be green. All exposed iron work in the interior shall receive two coats of green, including all piping, the mixer tank, gates, pumps and engines.

The ceilings shall receive two coats of concrete paint, white in color and made by Benjamin Moore & Co. or other approved paint made especially for concrete.

The wash water tank shall receive two coats of boiled linseed oil on the wood and one coat of asphaltum on the iron work.

The doors and frames shall receive two coats of approved lead and oil paint of a green color.

Compensation

The lump sum bid for this item shall be compensation for all work and materials required for the construction of one gate house and one filter house complete. It shall include every item of cost except those materials mentioned under other items.

STREAM CONTROL

Item No. 20

The Contractor shall receive compensation under this item for the special work of controlling the flow of the stream, for all damage caused by high water flows and for all structures which have to be built for the control of the stream flow not paid for under other items.

Order of Construction

For the diversion of the flow of the stream during the construction of the dam, the Contractor shall first cut out a bench in the rock on the south bank of the stream and construct thereon a concrete culvert with a central partition. The general location of this culvert is shown on the plans but since this is based only on the best information available as to the position of the rock, it is to be expected that the location of the culvert will be changed to conform to conditions as they are actually found.

Excavation for the culvert, the concrete and the steel will be paid for under the appropriate items.

As soon as this culvert is complete the Contractor shall construct a coffer dam, with its top at Elevation 415, across the stream and across the valley to divert the flow of the stream through the culvert. This coffer dam shall be constructed as rapidly as possible to reduce the chance of its being washed out by high water before it is complete. The coffer dam will be used as a permanent part of the dam as shown and will be paid for as rolled fill and riprap under the prices bid for these items, but it will only be paid for once, and, in the event that it is washed out, the Contractor shall replace it at his own expense.

The coffer dam shall be finished off at the culvert end with a stone filled crib as shown. The stone used for filling will be paid for as riprap but the cost of procuring and placing the logs shall be included in this item.

Likewise, the cost of any sheet piling which may prove necessary shall be included in this item and any other work or material which may be required to render the diversion complete and prevent undue seepage.

After the coffer dam is in place and the flow of the stream diverted through the culvert, the work of building the dam shall be carried out and also the work of the gate house shall be carried

When the dam and spillway are complete to the satisfaction of the Engineer and the time has arrived to fill the reservoir, the work shall proceed as follows:

Stop logs shall be placed before the screens in the south conduit of the culvert and all of the stream flow diverted through the north conduit. The south conduit shall then be thoroughly cleaned out and a 36 inch sluice gate placed in the south conduit on the upstream side of the gate house and securely concreted in place. When this concrete has set and the work completed to the satisfaction of the Engineer, the gate shall be opened, the stop logs removed and the entire flow of the stream diverted through the south conduit and the 36 inch gate.

Stop logs shall then be placed in the upstream set of grooves of the north conduit, made reasonably tight, and a temporary pump installed to remove all leakage through them. Permanent stop logs of oak shall then be placed in the second set of grooves of the north conduit, well and carefully filled and caulked absolutely tight with oakum. The tightness of this set of stop logs shall be tested by filling the space between the two sets with water and the caulking shall proceed until no leakage is found.

The 36 inch sluice gate shall next be closed and the reservoir allowed to fill. While it is being filled the second 36 inch sluice gate shall be placed at the bottom of the gate house shaft and the 24 inch cast iron pipe placed through the south conduit and connected to the 16 inch pipe with all fittings, supports and appurtenances.

In case the flow of the stream becomes too great for a single conduit to carry without interference with the work, work shall be suspended until the stream subsides, all debris cleaned away and damage repaired and the cost of such interference and suspension of work and damage shall be included in the lump sum price bid for this item.

Crib Work

Under this item the Contractor shall construct a rock filled crib at the upstream end of the culvert and at the south west corner of the coagulation basin as shown on the plans.

Cribs shall be built of sound logs not less than 10 inches in diameter at the butt and 6 inches at the tip and of the lengths shown. They shall be notched to fit and fastened with drift pins of one half inch diameter extending clear through the log. Any timber found on the land belonging to the Board may be used for this purpose if suitable but if the amount so found is not sufficient the Contractor shall provide additional logs at his own expense.

Excavation for that portion of the crib below the ground will be paid for under Item 2, and rock fill will be paid for under Item 8. All other materials and work of building the cribs shall be paid for under this item.

At least 50 per cent. of the stones used to fill the crib shall be of ½ cubic yard in size or greater. The remainder may be of any size larger than 6 inches in diameter.

Compensation

Compensation shall be the lump sum price bid for all work and materials required for the control and diversion of the flow of the stream and all damage to the works caused by high water of floods.

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GROUTING

Item No. 21

Under this item the Contractor shall drive holes into the rock at the bottom of the cutoff trench and seal the rock with grout.

Grout Holes

Holes shall be driven into the rock at the bottom of the cutoff trench at intervals of 8 feet. The depth of these holes shall be at least 10 feet below the surface of the rock and each hole shall be at least one inch in diameter. Holes may be driven with a jackhammer drill or by a core drilling machine as the Contractor may elect.

Into the top of each hole a piece of wrought steel pipe shall be securely set and caulked tight with jute soaked in cement grout for the attachment of the pipe or hose conveying the grout.

Grouting the Holes

Grout consisting of a liquid mixture of cement and water shall be forced into each hole in the following order:

Every fourth hole shall be grouted first until either the role refuses to take any more grout or grout appears on the surface of the rock in sufficient quantity to satisfy the Engineer that the voids of the rock are filled. After the grouting of the fourth holes the holes halfway between shall be grouted and finally the remaining holes.

Grout shall be forced into the holes under a maximum pressure of 40 pounds per square inch. The Contractor shall provide the equipment to enable this to be done and all grout required whatever the quantity may prove to be and the compensation therefore shall be included under this item.

Grouting the Cutoff Wall

Pipes of wrought steel one inch in diameter shall be set into the concrete of the cutoff wall extending from the surface of the rock up to the top of the wall. These pipes shall be spaced 10 ft. apart and shall be grouted in the same manner as specified for the holes in the rock, but using grout under 30 lbs. pressure.

Compensation

Compensation shall be the lump sum price bid and shall include all work and materials required for grouting the cutoff wall and the rock below as specified.

APPURTENANCES

Item No. 22

The Contractor shall furnish and place the appurtenances as listed and specified below and as shown on the drawings.

Copper Expansion Joints

Sheet copper water seals shall be placed in the walls and floor of the pure well. The copper used shall be pure soft sheet copper weighing not less than 16 oz. per sq. foot. It shall be bent and placed as shown and all joints between sheets of copper securely soldered.

Heating Plant

A complete hot air heating system shall be constructed in the filter building. The heater shall be as manufactured by the Thatcher Furnace Company, Newark, N. J., Size No. 165 or other heater of equal capacity and grate area, which has been accepted by the Engineer. It shall be set up on the concrete floor of the Pump Room complete and ready to operate. All exposed parts not galvanized shall be painted black. One set of firing tools shall be furnished, with shovels, poker and shaker. Grates shall be of the shaking and dumping type and shall be suitable for burning egg size anthracite coal.

The heater shall be connected to the chimney by a 10 in. smoke pipe of galvanized iron not less than No. 18 gauge, equipped with damper.

Three hot air pipes shall be installed, two to the floor directly above the heater and one to the top floor of the building. Sizes and locations of the hot air pipes shall be as shown on the plan. Each flue shall be rectangular in section, made of IX Bright Tin and shall be covered on the outside with one ply sheet asbestos securely fastened with paste. A damper shall be provided in each flue near the heater.

Registers shall be provided and set in the floor at the end of each hot air pipe and one extra shall be set into the floor under the alum tank and directly over the chlorine room. Registers shall be of cast iron as made by Putle Brothers, or others equally as good. They shall be neatly set in cement mortar.

The whole heating system shall be complete in every respect and ready to operate and all work shall be done in accordance with the best practice for work of this character.

Stop Logs

Stop logs shall be provided for temporary and permanent closing of the culvert through the dam and for regulating the flow into the gate house shaft.

Temporary logs for use at the upstream end of the culvert may be of any clear sound wood of sufficient strength to withstand the pressure and which has been approved by the Engineer. The logs for the permanent closing of the culvert shall be made of the best grade of white oak without knots, shakes, cracks or imperfections of any kind and shall be throughly air-seasoned. The logs for use in the gate house shaft shall be of clear air-seasoned oak of like quality.

Stop logs shall be constructed according to the details shown, finished all over, cut to fit and equipped with iron work shown. Sufficient logs shall be provided at the Gate House to fill the slot from top to bottom.

Baffles

Baffles shall be constructed in the coagulation basin and in the pure water reservoir. Baffles shall be made of rough sawed lumber and shall be reasonably sound, free from shakes, splits or cracks or knotholes, but absolutely clear lumber will not be required. Spruce, hemlock, fir, pine or cypress will be acceptable. Baffles shall be securely fastened in place according to the details shown. Structural steel supports will be paid for under Item 16.

Small Piping

All piping less than 4 four inches in diameter and all wrought steel pipe of any diameter shall be furnished and placed by the Contractor under this item together with all gates, cocks, fittings and supports required.

A complete water feeder system shall be installed carrying water from the wash water tank, 2 in. to the alum tank, ¾ in. to the chlorine machines, 2 in. to the soda tank, 1 in. to the 20-inch hydraulic valve, 1 in. to the pilot valve controlling the 16-inch inlet, 1 in. to the gasoline engines for cooling water, and ¾ in. to the washroom.

The feeder to the 20 in. hydraulic valve shall be connected to a ¾ inch Lunkenheimer packed key four-way valve which shall be connected to the two ends of the cylinder of the valve with 1 in. pipe and to a waste pipe running down the overflow pipe under the floor.

Each engine shall have a drain pipe of 1 in. pipe running to the pit under the floor. The 1 in. pipe feeding water to the pilot valve in the pump room shall be connected to the pilot valve and two lines of 1 in. pipe shall be run from the pilot valve to the cylinder of the 12 in. hydraulic valve on the raw water line and a 1 in. drain shall be run from the pilot valve to the pit under the floor.

A line of 2 in. wrought steel pipe shall be run from the soda tank to the 14 in. pure water pipe and there connected to it with a corporation cock. This line shall have all bends made with crosses with the free ends plugged.

A line of 2 in. brass pipe shall be run from the alum control boxes to the 16 in. raw water pipe and there connected with a brass corporation cock. All fittings on this line shall be of brass and all bends made with plugged crosses. A line of 4-inch cast iron soil pipe shall be run as a drain from the alum tanks to the main drain. Cast iron fittings shall be used on this pipe and the ends at the tanks shall be provided with short pieces of hard rubber pipe with soft rubber stoppers.

Drains of 1½ in. pipe shall be placed from each chemical control box to the 4 in. soil pipe drain.

A float tube of 10 in. w. s. pipe with a cap screwed on at the bottom shall be placed in the pump room and connected to the coagulation basin with 1 in. brass pipe equipped with a strainer at the coagulation basin end.

Eight inch w. s. pipe shall be placed to connect the discharge of the wash water pumps to the wash water tank. This pipe will be cast iron so far as the last flange shown and wrought steel thereafter. Six inch w. s. pipe shall be placed from the pump discharge line out into the coagulation basin. Hose connection valves shall be placed on this line and on the 8-inch line where shown. They shall have hose nipples with threads for standard 2½ in. hose couplings.

A three inch valve and brass nipple shall be placed on the effluent of each filter unit. A 2 in. brass pipe and strainer shall be placed at the overflow of the dam and connected to a vertical 12 in. cast iron pipe as shown.

Each alum solution tank shall be connected to its control box with a line of 1½ in. hard rubber pipe equipped with a hard rubber cock.

The control box for the soda solution shall be connected to the soda tank with a line of 1 inch wrought steel pipe.

A one inch hose bibb shall be placed at the alum solution box and connected to the 2 in. feeder with a 1 in. pipe. Hose bibbs shall also be placed at convenient points on the 1st and 2d floors and connected with the wash water supply with 1 in. pipes. A line of 1½ inch electric conduit shall be placed from the chlorine machine to the main effluent ready for the installation of the rubber hose which will be placed by the Board. A line of 4-inch pipe shall be placed to drain the roof into the wash water tank overflow. Six nipples of 6 in. brass pipe with cast iron flanges shall be placed at the controllers.

A line of six inch pipe shall be placed as an overflow for the wash water tank and run down to the surface of the filters. A special connection will be required where this pipe passes through the bottom of the tank as shown on the detail. A line of 2 in. pipe shall be run from the 8 in. riser to the bottom of the wash water tank and connected to it.

All lines of pipe shall be furnished with gate valves as required. Gates shall be placed wherever shown and also wherever they would be needed to give individual control of the various lines.

All small piping shall be carefully and neatly placed and all joints made perfectly tight.

Sanitary Disposal System

A complete sanitary disposal system shall be furnished and installed consisting of—

One Crane Co. "Eaton" enameled iron lavatory C2348-P5, and One Crane Co. "Nerwall" Washdown Closet C-11248 or other fixtures equally as good, connected by a line of 6 in. cast iron soil pipe drain to a cesspool near the shore of the stream as shown on the plans. All joints on the soil pipe shall be caulked tight with lead. Connections shall be made to the water supply from the wash water tank as speci-

fied under Small Piping and connections shall be made between the fixtures and the drain as necessary and required.

The cesspool shall be constructed of dry rubble masonry with its bottom not higher than elevation 392 and shall have a diameter of at least 10 feet. It shall be accessible through a cast iron manhole in the roof covered by at least 1 foot of earth.

The soil pipe drain shall be laid in a trench with a minimum cover of 3 feet. Trench excavation will be paid for under Item 4 but the furnishing and placing of the pipe shall come under this item together with the setting of the fixtures and connecting them up.

Filter Sand and Gravel

The Contractor shall after placing the filter drains furnish and place 9 in. of coarse gravel or crushed stone of sizes ranging from 1 in. to 2 in., and a layer 3 in. thick, with sizes varying from ½ in. to 1 in. This gravel or crushed stone shall consist of hard, durable particles, free from thin and long pieces. They shall be screened and washed free from clay, loam, dirt, particles smaller than specified and all other impurities. They shall be free from lime, magnesia and other soluble ingredients; and shall be tested by placing in one part of concentrated hydrochloric acid mixed with three parts of water for 24 hours, at a temperature of 70 deg. F. and when so treated and thereafter dried and weighed, shall not have lost more than 5 per cent. of their original weight.

The Board will furnish to the Contractor f. o. b. Catskill, the remainder of the filter gravel and sand, about 110 yards in all. The Contractor shall receive this material, haul it to the site of the filters, store it in bins and place it in the filters. Each grade of material shall be placed in each filter to the required depth and levelled perfectly smooth before any part of the material of the next layer is placed in the filter. In case the material has to be stored on the work before final placing bins shall be provided and the material shall be kept clean and the several grades kept separated.

Gutters

These shall be made of steel plate ¼ inch thick, rolled into a semi-cylindrical shape and provided with flanges made of bent angles. Flanges shall be faced and drilled. Blank flanges shall be furnished for closing the ends when required. Gutters shall be dipped in a bath of coal tar varnish and set carefully in the concrete with edges perfectly level and all at the same elevation.

Filter Laterals

The Contractor shall furnish and place the pipe laterals in the filter underdrains. They shall be made of 2½ inch genuine wrought iron pipe drilled and placed as shown. The ends shall be closed with caps.

One-half inch brass nipples and tees shall be placed on the top of the main collector as shown.

Manhole Covers

A manhole cover shall be furnished and placed in the roof of the pure water reservoir, in the floor of the pump room, and at the top of the drain manhole. The manhole covers for the pure well and the pump room shall be as made by the Canton Foundry and Machine Company, 101 West 31st Street, New York City. That for the pump room shall be a double leaf sidewalk door with flush surface size 48 in. x 48 in. That for the pure well shall be of like construction but single leaf size 24 in. x 24 in. The manhole cover for the drain manhole shall be as made by the Sessions Foundry Company, Bristol, Connecticut, and known as their Manhole Frame 976x with cover 977x or other castings of similar type.

Manhole covers shall be carefully and neatly set with cement and shall receive two coats of black asphaltum varnish.

Gate Operating Mechanism

The Contractor shall furnish and install the equipment for operating the quick opening valves as detailed on Sheet No. 22.

Trolley and Hoist

The Contractor shall furnish and place equipment on the top floor of the filter building, for handling bags of chemicals. The equipment shall consist of an electric hoist and trolley running on an overhead I beam. The I beam with all curves, switches and support will be paid for under Item 16. The hoist and trolley shall be paid for under this item and shall be of ¼ ton capacity as manufactured by the Yale and Towne Manufacturing Company or equal. Sufficient chain shall be furnished with the hoist to allow of the hoisting of material from the level of the ground to 4 feet above the top floor. The hoist shall be equipped with an electric motor wound for 110 volts. The current which will be used may be direct current or single phase alternating current at 60 cycles. The Contractor shall furnish a hoist with a motor adapted for the current which will be available as subsequently directed.

Alum Bin

A wooden bin shall be built on the top floor for storage of alum. The bin shall be built of clear sound pine, finished both sides according to the detail shown. It shall receive two coats of dark green lead and oil paint.

Waterproofing

The inside of the walls and floor of the pure water reservoir and of the filter boxes shall receive two coats of Minwax Heavy Clear Waterproofing as sold by the Minwax Company, Incorporated, 11 West 42d Street, New York City. The application of this material shall be made strictly according to the directions of the manufacturer.

Chemical Feed Boxes

The Board will furnish the chemical control feed boxes for the alum and soda solution. The Contractor shall install these boxes and connect them to the solution tanks and shall run two lines of one half inch pipe from the control boxes on the top floor to the pilot valve in the pump room with valves and fittings as required.

Aerator Nozzles

The Board will furnish the aerator nozzles and the Contractor shall receive, store and install them.

Gauges

The Board will furnish the loss of head and rate of flow gauges and the Venturi meter register. The Contractor shall receive and care for this material and shall set it up carefully according to the directions of the manufacturers and shall furnish and place ½ inch brass piping to connect these gauges with the Venturi meters which operate them. Shutoff valves shall be placed on all lines and a strainer on the loss of head connection to the filters.

Mixer Tank

The Contractor shall furnish and place a mixer tank of sheet steel on the raw water line to the coagulation basin located in the pump room. This tank shall be made of a grade of steel known as fire box, according to Specification A70-27 of the American Society of Testing Materials.

The thickness of the shell shall be 5-16 inches and of the heads ½ inch.

The heads shall be dished to a radius of 6 feet and shall be securely welded or riveted in place. Joints in the shell may be either welded or riveted as the Contractor may elect. Two Flanged connections for 16-inch pipe shall be provided and one for 12-inch pipe. Flanged connections shall be made of forged, pressed or cast steel with flanges faced and drilled to American Standard dimensions. Flanged connections shall be securely riveted or welded to the tank with the axis of the outlet tangential to the cylinder of the tank as shown.

A manhole shall be provided for access to the interior of the tank securely bolted in place and made absolutely tight with a gasket. This manhole shall have a clear opening of not less than 14 in. x 16 in.

Stiffening rings of 2 in. x 2 in. x ¼ in. angles shall be placed approximately 2 feet center to center on the exterior of the tank.

Pads with 2 in. standard pipe taps shall be provided, one on the top of the tank and one on the side near the bottom as shown.

The tank shall be coated with an approved coating, inside and out, coal tar pitch varnish preferred.

The tank shall be carefully set in place and connected to the piping. The tank shall be made by the Walsh Steam Boiler Works of Holyoke, Massachusetts, or other approved manufacturer.

Soda Tank

A steel tank for mixing and applying soda solution shall be furnished and placed as shown. This tank shall be made of ¼-inch steel plates with welded joints.

Pads tapped for screwed pipe shall be attached as shown.

The tank shall be coated with approved coating inside and out, coal tar pitch varnish preferred. The tank shall be carefully set in place with its supports and connections.

Wash Water Tank

This shall be a wooden tank as manufactured and erected by the Atlantic Tank Corporation, North Bergen, New Jersey, or equal. It shall be 31 ft. 6 in. diameter by 11 ft. 0 in. deep inside, and shall have a capacity of 64,000 gallons. The staves shall be made of clear California Red Wood, 3 in. thick. Dunnage shall be of 4 in. x 6 in. Yellow Pine. Hoops shall be of round iron with draw lugs, two of ⅞ in. diameter and 11 of 1 in.

The tank shall be carefully erected on the top floor of the filter building and all pipe connections made as shown.

Wood Platform at Alum Tank

A platform and stairs of wood shall be constructed at the alum tanks. They shall be built of clear spruce or pine and shall receive two coats of green lead and oil paint.

Seeding

The top and downstream face of the dam, the outside slopes of the coagulation basin and the surface of all fills around the Purification Plant shall be covered with a layer of top soil carefully dressed to grade. Upon the surface thus prepared the Contractor shall distribute an approved fertilizer and then sow a mixture of rye and grass seed, 110 pounds per acre.

Copper Hood at Overflow

The top of the overflow pipe in the coagulation basin shall be protected from spray by a hood of sheet copper constructed to the detail given on the plans.

The copper shall be 16 ounce copper. All joints shall be riveted.

Culvert Pipe

A 48 in. culvert pipe of cast iron shall be placed under the dike where the road has been raised. This pipe shall be as made by the National American Casting Company, Birmingham, Alabama, or other pipe equally as good. Culvert pipe of reinforced concrete will also be accepted provided the design has been approved by the Engineer.

Railings

The Contractor shall furnish and place galvanized iron hand rails in the filter building and on the bridge to the gate house at the dam.

Railings shall be of standard 1½ in. pipe, with 2 in. posts. Posts shall have flanges bolted to the concrete.

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Automatic Air Valve

An automatic poppet air valve as made by the Eddy Valve Company of Waterford, New York, shall be placed on the 12 in. outlet pipe at the top of the mixer tank. The valve shall have 1½ in. screwed ends and shall be furnished and placed under this item.

Level Gauge For Pure Well

A gauge for indicating the level of water in the pure well will be furnished by the Board and shall be placed under this item. It will consist of a float and chain with a length of 3-inch pipe surmounted by a pulley.

GENERAL CLAUSES

Alteration

The Contractor agrees to perform all the work contracted for as specified in this contract, but any alterations in the form, dimensions, location or manner of doing the work, ordered in writing by the Engineer, shall be made as directed; and when the several quantities of work, or any of them, from this or any other cause shall be increased beyond the amount or amounts exhibited at the time of letting this contract, the Contractor agrees to perform the remaining work at the prices stipulated in his contract, and to make no claim for damages in consequence of such increase or diminution.

Time

The Contractor shall commence work on the ground within ten days from the date of mailing by the Board of notice to the successful bidder at the business address given in the bid that the contract and bond have been executed to the satisfaction and approval of the Board, and the work shall be completed on or before December 1, 1930.

Barriers

The Contractor shall maintain at all times a good and sufficient fence, railing or barrier around all exposed portions of said work in such a manner as to prevent accidents; and it shall also be the duty of said Contractor to place upon such barriers, fence or railing, at evening twilight on each day, suitable and sufficient colored lights, and to keep them burning during the night. The Contractor shall also put up and maintain suitable red lights and such other protection as shall be necessary by reason of any material he may have placed in the highway.

Proper Methods and Appliances to Be Used

If at any time before commencement or during the progress of the work, the methods and appliances used or to be used appear to the Engineer to be inefficient or inappropriate for securing the quality of work required or the said rate of progress, he may order the Contractor to increase their efficiency or improve their character, and the Contractor shall conform to such order; but the failure of the Engineer to demand an increase of such efficiency or improvement in character shall not relieve the Contractor from his obligation to secure the quality of work and the rate of progress established in the specifications.

Explosives

Explosives in proper quantities shall be stored in a secure and approved manner, and only at approved places, and as allowed by the laws of New York, and the ordinances of said Village of Catskill, New York. They shall be handled with care and shall be at all times under special charge of a competent watchman.

Workmanship and Materials

All materials furnished under this agreement, unless otherwise provided, shall be the best of their respective kinds, and all the work contemplated and described in this agreement and the specifications

forming a part thereof, shall be done in a good and workmanlike manner, to the satisfaction of the Engineer, and he shall have the right to correct any errors or omissions in the contract or specifications when such corrections are necessary for the proper fulfillment of their intention. The action of such corrections shall date from the time that the Engineer gives due notice thereof, and any alterations in the work, rendered necessary thereby, shall be made as directed.

Plans and Specifications

This contract, and the specifications herein contained, and the plans herein referred to, may be modified and changed from time to time, as may be agreed in writing between the parties hereto, in a manner not materially affecting the substance thereof or materially changing the price to be paid, in order to carry out and complete more fully and perfectly the work herein agreed to be done and performed.

The plans and specifications are intended to be explanatory of each other, but should any discrepancy appear, or any misunderstanding arise, as to the import of anything contained in either, the explanation of the Engineer shall be final and binding on the Contractor, and all directions and explanations required, alluded to, or necessary to complete any of the provisions of such specifications and give them due effect, will be given by the Engineer.

Access to Work

The Contractor shall permit the Engineer, and his assistants, and persons designated by him or them, and other representatives of the Board, to enter upon the work at all times and places, and to give lines and grades and to measure and inspect the work or materials and shall provide safe and proper facilities therefore and such samples as may be required. The Contractor shall notify the Engineer, at a reasonable time in advance, of the starting of any new class of work. In case any work is to be done at night the Contractor shall give due notice to the Engineer, at least two days before such work is started. Only such classes of work shall be done at night as can be properly inspected, and adequate light and facilities for inspection shall be supplied. The Contractor will not, however, be thereby relieved of his obligation to supervise the work and to fulfill in every respect his contract. If the inspector should be absent or negligent, or should consent to the allowance of inferior work, the Contractor will not be thereby excused from repairing the work and removing faulty materials at his own cost. The Contractor shall at all times furnish the Engineer reasonable notice for the purpose of inspecting the materials furnished and the work done under this agreement.

Winter Work

No concrete shall be placed or other work done which is subject to damage by frost or rain.

Lines and Grades

All lines and grades will be given by the Engineer, but the Contractor shall provide such material and give such assistance therefor

as may be required by the Engineer, and the marks so given shall be carefully preserved.

Removal of Temporary Structures

On or before the completion of the work the Contractor shall, excepting as otherwise expressly directed or permitted in writing, tear down and remove all temporary buildings and structures built by him and all rubbish of all kinds from the grounds which he has occupied, and shall leave the spoil banks and other parts of the grounds, which may have been affected by his operations, in a neat and satisfactory condition.

Conveniences

The Contractor shall construct necessary conveniences, properly secluded from observation, wherever needed for use of laborers, and shall keep the same deodorized so that they shall not become a nuisance.

Competent Men

The Contractor shall employ competent and skillful men to do the work, and whenever the Engineer shall inform him that any man on the work is, in his opinion, incompetent, unfaithful or disorderly, or uses threatening or abusive language to any official having supervision of the work, such man shall be discharged from the work and shall not again be employed on it except with the consent of the Engineer.

Ordinances

The Contractor shall keep himself informed and shall at all times observe and comply with all existing or future Acts of the Legislature, all requirements and provisions of the Charter of the Village of Catskill, and all municipal ordinances affecting the conduct of the work.

Partial Payments

Within twenty days from the expiration of each month in which work herein contracted for shall be prosecuted according to the terms and conditions of this contract, the Board will pay therefor ninety per cent. of the amount due for materials delivered upon the ground and work done and performed during the preceding month, based upon the Engineer's estimate of the proportion of the whole of said work done and upon the approval of the Board, but if at any time after such payments have been made it shall be found that any of the work included in the estimates on which such payments have been made has been performed in an unworkmanlike manner or contrary to these specifications, the Engineer shall direct the Contractor to take down and re-build such work in the manner required by the specifications, and no further payments on this contract shall be made until such directions have been in all respects complied with.

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Prices

The Board agrees to pay, and the Contractor agrees to accept and receive, the prices specified in the proposal submitted by him as full compensation for furnishing all the materials called for not found in the work, and for all labor and use of tools and other implements necessary for executing the work contemplated in this contract; also for all loss or damage arising out of the nature of the work, or from the action of the elements, or from any unforseen obstructions or difficulties which may be encountered in the prosecution of the work, and for all reasons of every description connected therewith; also for all expense incurred by and in consequence of the suspension or discontinuance of said work, and the whole thereof according to the plans and specifications and requirements of the Engineer under them, which said prices are as follows, to wit:

CONTRACT NO. 2

Item 1: For clearing, the sum of .... dollars and ..... cents ($ ..... per acre.

Item 2: For earth excavation, including spillway, borrow pits and everything but trench, the sum of .... dollars and ..... cents ($ ..... per cubic yard.

Item 3: For trench excavation for cutoff wall, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 4: For trench excavation for piping, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 5: For rock excavation, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 6: For earth fill, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 7: For rolled embankment, including core, the sum of ..... dollars and ..... cents ($ .....) per cubic yard.

Item 8: For rip rap, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 9: For paving on slopes, the sum of .... dollars and ..... cents ($ .....) per square yard.

Item 10: For paving floor of coagulation basin, the sum of ..... dollars and ..... cents ($ .....) per square yard.

Item 11: For fill of crushed stone, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 12: For concrete in foundation floors, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 13: For concrete in heavy walls, the sum of .... dollars and ..... cents ($ .....) per cubic yard.

Item 14: For all other concrete, the sum of .... dollars and ..... cents ($ ....) per cubic yard.

Item 15: For steel reinforcement, the sum of .... dollars and ..... ($ .....) per pound.

Item 16: For structural Steel, the sum of .... dollars and ..... cents ($ .....) per pound.

Item 17: For placing cast iron pipe, fittings and gates, the sum of ..... dollars and ..... cents ($ .....) per ton.

Item 18: For tile drains, the lump sum of .... dollars and ..... cents ($ .....).

Item 19: For buildings, the lump sum of .....
.....dollars and ..... cents
($ .....).

Item 20: For stream control, the lump sum of .....
..... dollars and .....
cents ($ .....).

Item 21: For grouting, the lump sum of .....
..... dollars and .....
cents ($ .....).

Item 22: For appurtenances, the lump sum of .....
..... dollars and .....
..... cents ($ .....).

For extra work or materials, if any, the reasonable cost of the work or materials as agreed or as determined by the Engineer, plus ten (10) per cent. of such cost.

Ten Per cent of the value of the work done and materials furnished under this contract, at the contract prices thereof, shall be reserved by the Board until the whole work which is the subject of this contract shall be fully and entirely completed.

Repairs

The Contractor agrees to make all the needed repairs on the said work during a period of one year after its final completion; and he agrees that the Board is authorized to retain out of the moneys payable to him under this agreement the sum of two per cent on the amount of the contract, and to expend the same, or as much thereof as may be required, in making the aforesaid repairs to the satisfaction of the Engineer, if within ten days after the delivery or mailing of a notice in writing to the Contractor or his agents, they shall neglect to make the aforesaid repairs, provided, however, that in case of an emergency, where, in the opinion of the Engineer, delay would cause serious loss or damage, the Board may make repairs without previous notice and at the expense of the Contractor.

Final Account

It is agreed that the Engineer shall, in all cases, determine the amount or quantity of the several kinds of work which are to be paid for under this contract and the amount of compensation to be paid therefor, which compensation shall be at the rates agreed upon for the item of work herein specified, or a just and reasonable price for necessary extra work done, directed and ordered pursuant to this contract and not otherwsee provided for, and shall, within thirty days, after the work shall in all respects have been completed according to the terms and conditions of this contract, present final account and estimate of the same to the Board, who shall review, and, when satis-

factory, approve the same, and the Board shall pay the entire sum so found to be due hereunder after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained, under the provisions of this contract. All prior estimates and payments shall be subject to correction in the final account and payment.

Extra Work

The Contractor shall do any work not herein otherwise provided for which may be necessary for the proper completion of the work, if required; but no such work shall be allowed or paid for except upon a written order signed by the President of the Board of Water Commissioners, at prices agreed upon and stated in said order, or in the absence of such agreement, at the direct cost with ten per cent. (10%) added, and there shall be no claim for extra work or materials or articles except under this article. The direct cost shall include the cost of mechanics, laborers and materials furnished, and a reasonable allowance for foreman's time and for liability insurance. It shall not include any charge for ordinary tools nor for time spent by the Contractor nor for general expenses of the Contractor's office. Costs to be allowed under extra work shall be agreed upon daily by the Contractor and the Engineer, and the Engineer shall have access to the payrolls and bills for labor and materials used in order to determine said labor and material cost.

Account for Work

The Contractor shall, before the tenth day of the month succeeding that in which any extra work is done or materials furnished file with the Engineer and with the Board a claim for such damage or extra work or materials, with the order or a copy thereof, on which such work or materials were furnished. In case the Contractor fails to so file such a claim for such extra work done or materials furnished, he shall have no claim for compensation for the same against the said Board.

Responsibility for the Work

The Contractor shall be held responsible for any or all materials or work done to the full amount of all payments made thereon, and he will be required to make good at his own cost any injury or damage which said materials or work may sustain from any sources or causes whatever before the final acceptance thereof.

Conditions Under Which Board May Complete Work

If the work to be done under this contract shall be abandoned, or if the contract shall be sublet, or the contract or any claim thereunder shall be assigned by the Contractor, or, if at any time the Engineer shall be of the opinion, and shall so certify in writing to the Board, that the conditions specified as to the rate of progress are not fulfilled, or that the work or any part thereof is unnecessarily delayed, or that the Contractor is violating any of the provisions of this Contract, the Board may notify the Contractor to fulfill the conditions of the contract; and should the Contractor fail to comply

with said notice within three days, the Board may notify the Contractor to discontinue all work, or any part thereof, and thereupon the Contractor shall discontinue said work, or said part thereof as the Board may designate, and the Board may thereupon, by contract or otherwise, as it may determine, complete the work or such part thereof and charge the expenses thereof to the Contractor, and may take possession of and use therein such materials, animals, machinery, implements, and tools of every description as may be found upon the work. The expense so incurred shall be deducted and paid by the Board out of any moneys then due or to become the Contractor under this contract, or any part thereof, and in case such expense is less than the sum which would have been payable under this contract if the same had been completed by the Contractor, the Contractor shall be entitled to receive the difference and in case such expense shall exceed the latter sum, the Contractor shall pay the amount of excess to the Board.

Abandonment of Work

In case of any neglect or refusal on the part of the Contractor to perform the whole of the work, or furnish all the materials or complete the entire work within the time herein specified therefor (unless such time has been extended as aforesaid), so that such neglect or refusal may be construed as an abandonment of the work on this contract, then and in that event, the Contractor in every such case shall forfeit all right or claim for any compensation whatsoever for any part of such work, which may have been so furnished under and in pursuance of this agreement, in addition to the damages for which he shall be liable to the Board or said Village on account of any injury sustained by the said Board or said Village arising from the neglect or default of the said Contractor in respect to said work, and the Board or said Village shall not be in any manner liable.

Suspension of Work

The Engineer of the Board shall have the power, at any time, to suspend the execution of the work under this contract and the Board shall have the power to continue such suspension, and in its discretion, to vacate this contract, either for neglect or refusal to proceed with the work, or for a violation of any or either of the covenants, terms, conditions and provisions of this contract, without rendering the said Board and the said Village liable for any damages therefor, and without in any degree affecting any liability upon the bond given, by or on behalf of the Contractor thereto.

Damage to Existing Structures

In case any damage or injury results to any pipes, conduits, lamp posts, lamps, poles, buildings or property of any description through or by reason of any negligence, carelessness or want of skill on the part of the Contractor, his agents or servants, the Contractor shall become liable to pay such amounts as may be sufficient to cover the expense and damage occasioned by such negligence, carelessness or unskillfulness; and such amount shall be charged against the Contractor, and may be deducted from any sum or sums due or to become due or payable to the Contractor on account of this contract.

Indemnity

The Contractor shall indemnify and save harmless the Board and said Village of and from all loss or damage caused to any person or property by reason of any carelessness or negligence in the doing or making of the improvement, or furnishing of material, and by reason of failure to pay all laborers, mechanics, sub-contractors and material men, and all persons who shall supply said Contractor with materials, provisions and supplies for the performance and completion of said contract, and to promptly pay all just debts, dues and demands incurred in the performance of said contract; and further to indemnify and save harmless of and from all suits and actions said Board and said Village on account of any injuries or damages sustained by any person or persons by reason of any act, omission or negligence, or by the use of improper or defective material on the part of said Contractor in the performance of any part of this contract; and further to indemnify and protect and save said Board and said Village harmless against any and all demands, fees or royalties for any patented invention, materials, articles, methods, arrangement or process of manufacture, or any infringement thereof, that may be used on or be in any manner connected with the construction, erection or maintenance of the work, material, or any part thereof embraced in this contract. And the Board or said Village shall have the right to retain from the Contract price such sum as shall enable it to pay the amount of any claim, and the cost and disbursements of any suit brought against the Board or said Village therefor, until the validity of any such claim shall be established, and finally determined, and if established and finally determined the same shall be paid for the amount so retained; otherwise such amount shall be paid over to the Contractor.

City Not Estopped

It is agreed and understood by and between the parties hereto that the Board or said Village, its successors and assigns, shall not be precluded or estopped by any return or certificates made or given by the Engineer, inspector or other officer, agent or appointee of the Board, under or in pursuance of anything in this agreement contained, from at any time showing failure of performance of any or either of the conditions of this contract, or the true and corrected amount and character of the work which shall have been done, and materials which shall have been furnished by the Contractor, or any person or persons under this agreement, nor from at any and all times withholding payment of the several sums herein specified until the Contractor when thereunto required on behalf of the Board, shall make and furnish sufficient and independent proof of the quantity and quality of the work done and materials furnished under this agreement.

No Damages For Delay

The Contractor shall have no claim for damages on account of any delay on the part of the Board in furnishing the pipes, gates or

other materials, or on account of any delay occasioned by the necessity of removing or changing the location of any water, or gas pipe, any sewer drain, telephone conduit or other structure, but in case of such delay for either of these reasons the Contractor shall be entitled to so much additional time wherein to perform and complete this contract on his part as the Engineer shall certify to be just.

Notice to Contractor

It is agreed that the residence or place of business given in the bid upon which this contract is founded, is hereby designated as the place where all notices, letters and other communications may be served, mailed or delivered. It is further agreed that any notice, letter or other communication addressed to the Contractor and delivered at the above named place, or deposited in a post-paid wrapper in any post-office box regularly maintained by the post office, shall be deemed sufficient service thereof upon the Contractor. It is also further agreed that the place named may be changed at any time by an instrument in writing, executed and acknowledged by the Contractor and delivered to the Board, but nothing herein contained shall be deemed to preclude or render inoperative the service of any notice, letter or other communication upon the Contractor personally, should the Board elect to make such personal service.

Not to Sublet Contract

The Contractor expressly agrees that he will not assign, tranfer, convey, sublet or otherwise dispose of these specifications or this contract, or in any wise divest himself of his right, title or interest therein, or of his power to execute the same, to any person, firm or corporation, without the previous consent in writing of the Board.

Payment of Persons Employed

No payment shall become due or be made to the Contractor upon any work performed by him, unless prior to the time fixed for such payment the Contractor presents to the Board, and the Treasurer of the Village of Catskill, satisfactory proof that all persons employed in and about the work have been paid all amounts due them for said work, or that such persons have been properly secured in their claims against the work.

Order For Payment of Money

It is expressly understood, and the Contractor hereby expressly covenants and agrees, that no orders for the payment of any moneys due or to become due under this contract shall be given, and none of the moneys due or to become due under this contract shall be assigned by the Contractor without the previous consent in writing of the Board.

Contractor Shall Prevent Filing of Liens

The Contractor shall not at any time suffer or permit any lien, attachment or other incumbrance under the laws of the State or otherwise by any person or corporation whatsoever to remain on file in the office of the Board or in the office of the Treasurer of the Village of Catskill, against any money due or to become due for any work done

or materials furnished under this contract, or by reason of any other claim or demand against the Contractor, and any such lien, attachment or incumbrance, until it is removed, shall preclude any and all claims or demands for any payment whatsoever under or by virtue of this contract.

Stipulated Damages and Bonus

If the Contractor fails to fully and entirely complete and finish the work in conformity to the terms and provisions of these specifications and either or both of these contracts within the time hereinbefore specified, he shall pay to the Board of Water Commissioners, Catskill, New York the sum of one hundred dollars ($100.) for each and every day thereafter including Sundays and Holidays that the finishing of the contract is delayed which sum shall be construed as stipulated and liquidated damages and not as a penalty, and shall be deducted from the amount due by the terms of the contract; provided, however, that in case of justifiable delay, the Board shall have the right to extend the time for the completion of said work, with or without the remission of the above-mentioned sum agreed upon as stipulated and liquidated damages, during the time of said extension but no extension of time for any reason beyond the time fixed herein for the completion of the work, nor the doing of any part of the work called for by this contract shall be deemed to be a waiver by said Board of the right to abrogate this contract for abandonment or delay. And if the Contractor shall fully complete same before the time specified, he shall receive an extra or additional payment of fifty dollars ($50.) for each and every day that his work is so finished before the time specified.

Workmen's Compensation Law

It is hereby expressly convenanted and agreed by and between the parties hereto, that this contract shall be void and of no effect, upon the failure of the Contractor, the party of the second part, to forthwith secure compensation for the benefit of, and keep insured during the life of this contract, all employees engaged thereon, in compliance with the provisions of Chapter 816 of the Laws of 1913, as amended and re-enacted by Chapter 41 of the Laws of 1914, constituting Chapter 67 of the Consolidated Laws of the State of New York, known as the Workmen's Compensation Law, and of all acts amendatory thereof; and the Contractor shall within ten days after the execution and delivery of this contract submit to the Board satisfactory proof that the provisions of said Workmen's Compensation Law have been complied with, in default of which the Board may forthwith declare this contract forfeited.

Labor Law

The Contractor shall forthwith and at all times comply with all the provisions of Sections 160, 220, and 222 of Chapter 50 of the Laws of 1921, constituting Chapter 31 of the Consolidated Laws of the State of New York, known as the Labor Law, and of all acts amendatory thereof.

Labor Law—Day's Work

No laborer, workman or mechanic in the employ of the Contractor, sub-contractor or other person doing or contracting the whole or part of the work contemplated by this contract, shall be permitted or required to work more than eight hours in any one calendar day, except in cases of extraordinary emergency, caused by fire, flood or danger to life or property, and no such person shall be employed more than eight hours in any day except in such emergency, as provided by Section 220 of the Labor Law.

Labor Law—Preference in Employment to Be Given to Citizens of Catskill

In construction of the Public Work provided to be done and performed by the Contractor under the terms of this contract, preference shall be given to citizens of Catskill. If they are not available, then citizens of the United States shall be employed. Aliens may be employed when citizens are not available, as provided by Section 222 of the Labor Law. If said section is not complied with, this contract shall be void.

IN WITNESS WHEREOF, the said parties of the first part have hereunto, and to two other original agreements of like tenor and date, set their corporate seal, and have caused the same to be signed by a majority of the Board of Water Commissioners of the Village of Catskill, and the party of the second part have hereunto, and to two other original agreements of like tenor, and date, set their hands and seals, the day and year first abovementioned.

THE VILLAGE OF CATSKILL, by

Board of Water Commissioners, by

.....)
President

Members of
.....) Board of Water Commissioners

.....)

.....)

.....)

.....)
.....) Party of the second part

.....)

In the presence of

.....

.....

.....

.....

The aforesaid Contract approved and confirmed by the Board of Trustees of the Village of Catskill at meeting of .....

..... and approved by the President.

Attest:

.....
Village Clerk.

DEC

PRESIDENT'S ACKNOWLEDGMENT

STATE OF NEW YORK,
COUNTY OF } SS.:

before me personally came .....

On this ..... day of ..... 1930.

to me known and known to me to be the President of the Board of Trustees of the Village of Catskill, the person described as such in and who as such executed the foregoing instrument, and he acknowledged to me that he executed the same as said President for the purposes therein mentioned.

.....
Notary Public

F3-35

ACKNOWLEDGMENT BY CORPORATION

STATE OF NEW YORK,
County of ..... } SS.:

On this ..... day of 1930,

before me personally came .....

to me known, who being by me duly sworn, did depose and say that

he resides in .....

that he is the ..... of the .....

....., the corporation described

in and which executed the foregoing instrument; that he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Trustees of said corporation, and that he signed his name thereto by like order.

.....
Notary Public

ACKNOWLEDGMENT BY CONTRACTOR, IF AN INDIVIDUAL

STATE OF NEW YORK,
County of ..... } SS.:

On this ..... day of 1930,

before me personally came .....

to me known and known to me to be the same person described in and who executed the foregoing instrument, and he acknowledged to me that he executed the same for the purposes therein mentioned.

.....
Notary Public

PEC

ACKNOWLEDGMENT BY A FIRM

STATE OF NEW YORK, }
County of ..... } SS.:

On this ..... day of 1930,

before me personally came .....

to me known and known to me to be the members of .....

....., the firm described in and

which executed the foregoing instrument, and they acknowledged to me that they executed the same as the act and deed of and in behalf of said firm for the purposes therein mentioned.

.....
Notary Public

F3-36

BOND

KNOW ALL MEN BY THESE PRESENTS, That we .....
....., as principals, and
..... as surety, are held and firmly bound unto the Village of Catskill, a municipal corporation of the State of New York in the penal sum of
..... dollars, lawful money of the United States of America, to be paid to the said Village of Catskill, its successors or assigns, for which payment, well and truly to be made, we bind ourselves, and each of our heirs, executors and administrators, successors, and assigns, jointly and severally, firmly by these presents.

Sealed with our seals. Dated .....
the ..... day of ..... one thousand nine hundred and thirty.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if ...
.....
the principal ... hereto shall well and truly perform the work and furnish the materials in accordance with the annexed contract dated the ..... day of ..... 1930 therefor and the plans and specifications therein referred to, then this obligation to be void, otherwise to be in full force and effect.

And the said principal... and suret... hereby further bind themselves, their successors, heirs, executors and administrators, jointly and severally, that they will amply and fully protect the said Village of Catskill against, and will pay any and all amounts, damages, costs and judgments which may be recovered against, or which the said Village of Catskill may be called upon to pay, to any person or corporation by reason of any damages arising out of the doing of said work, or of the neglect of the said principal... or principal's agents or servants, or the repair or maintenance thereof, or the manner of doing the same, or the improper performance of the said work by the principal... or principal's agents, or servants, or the infringement of any patent or patent rights by reason of the use of any materials furnished or work done as aforesaid or otherwise.

And the said principal... and suret... hereby stipulate and agree that no change, extension, alteration or addition to the terms of the contract or specifications shall in any wise affect their obligation on this bond.

IN WITNESS WHEREOF, the said principal... and surety have hereto affixed their respective seals and duly subscribed these presents the day and year above written.

..... (L. S.)
..... (L. S.)
..... (L. S.)

DEC

ACKNOWLEDGMENT BY CORPORATION-CONTRACTOR

STATE OF NEW YORK, }
County of ..... } SS.:

On this ..... day of 1930,

before me personally came .....

to me known, who being by me duly sworn, did depose and say that

he resides in ..... that he is the

..... of the .....

..... the corporation described in

and which executed the foregoing instrument; that he knows the seal of said corporation; that the seal affixed to said instrument is such corporate seal; that it was so affixed by order of the Board of Trustees, and that he signed his name thereto by like order.

.....
Notary Public

F3-37

ACKNOWLEDGMENT BY CONTRACTOR, IF AN INDIVIDUAL

STATE OF NEW YORK, }
County of ..... } SS.:

On this ..... day of 1930,

before me personally came .....

to me known and known to me to be the same person described in and who executed the foregoing instrument, and he acknowledged to me that he executed the same for the purposes therein mentioned.

.....
Notary Public

ACKNOWLEDGMENT BY A FIRM

STATE OF NEW YORK, }
County of ..... } SS.:

On this ..... day of 1930,

before me personally came .....

to me known and known to me to be the members of .....

..... the firm described in and which exe-

cuted the foregoing instrument, and they acknowledged to me that they executed the same as the act and deed of and in behalf of said firm for the purposes therein mentioned.

.....
Notary Public

(The Surety Company executing the bond must append proper corporate acknowledgment and statement of its financial condition, and a copy of the resolution authorizing the execution of bond by officers of the company.)

DEC

SCHEDULE OF MATERIAL TO BE FURNISHED BY THE BOARD AND PLACED BY THE CONTRACTOR

121 Tons of Cast Iron Bell and Spigot Pipe

21000 Pounds of Standard Cast Iron Specials

44000 Pounds of Special Cast Iron Specials

All valves and gates 4 in. or more in diameter except valves with screwed ends

40 Aerator Nozzles

1 Level Indicator

110 cubic yards of Filter Sand and Gravel

6 — Filter Controllers

2 — Venturi Meter Tubes

1 — Loss of Head Gauge

1 — Rate of Flow Gauge

1 — Venturi Meter Register

1 — Pilot Valve

3 — Chemical Control Boxes

1 — Regulating Float Valve

F3-38

2-27-29-500 (11E-3147)

STATE OF NEW YORK

DEPARTMENT OF PUBLIC WORKS

DIVISION OF ENGINEERING

ALBANY

Received [illegible] 1930 Dam No. 209-810

Disposition Appr. 5-5-1930 Watershed Lower Hudson

Foundation inspected

Structure inspected

Application for the Construction or Reconstruction of a Dam

Application is hereby made to the Superintendent of Public Works, Albany, N. Y., in compliance with the provisions of Section 948 of the Conservation Law (see last page of this application) for the approval of specifications and detailed drawings, marked Catskill Water Works, Dam & Filters, Contract No. 2

herewith submitted for the { construction / reconstruction } of a dam herein described. All provisions of law will be complied with in the erection of the proposed dam. It is intended to complete the work covered by the application about December 1, 1930 (Date)

1. The dam will be on W. Br. Potuck Creek (Cob Creek) flowing into Catskill Creek in the town of Coxsackie, County of Greene and 1200 feet above Union Church Bridge (Give exact distance and direction from a well-known bridge, dam, village main cross-roads or mouth of a stream)

2. Location of dam is shown on the Coxsackie quadrangle of the United States Geological Survey.

3. The name of the owner is Village of Catskill

4. The address of the owner is Catskill, N. Y.

5. The dam will be used for Water Supply

6. Will any part of the dam be built upon or its pond flood any State lands? No

7. The watershed above the proposed dam is 19.3 square miles.

8. The proposed dam will create a pond area at the spillcrest elevation of 68.8 acres and will impound 23 Million cubic feet of water.

DEC

9. The maximum height of the proposed dam above the bed of the stream is 34 (earth portion) feet 0 inches.

10. The lowest part of the natural shore of the pond is ..... feet vertically above the spillcrest, (Spillway about 6' high) and everywhere else the shore will be at least ..... feet above the spillcrest. (over bed rock)

11. State if any damage to life or to any buildings, roads or other property could be caused by any possible failure of the proposed dam Two small highway bridges, a few barns, one annex to summer boarding house, one grist mill.

12. The natural material of the bed on which the proposed dam will rest is (clay, sand, gravel, boulders, granite, shale, slate, limestone, etc.) Sand, gravel and shale

13. Facing down stream, what is the nature of material composing the right bank? Rock, gravel, sandy loam

14. Facing down stream, what is the nature of the material composing the left bank? Rock, gravel sandy loam

15. State the character of the bed and the banks in respect to the hardness, perviousness, water bearing, effect of exposure to air and to water, uniformity, etc. Rock lies from 7 to 17 feet below surface. Overburden pervious but water bearing only in bed of stream. Fairly uniform mixture of loam, sand, gravel & boulders

16. Are there any porous seams or fissures beneath the foundation of the proposed dam? Yes there are seams in the bluestone shale. These will be grouted.

17. WASTES. The spillway of the above proposed dam will be 140 feet long in the clear; the waters will be held at the right end by a Rock & Concrete the top of which will be 10 feet above the spillcrest, and have a top width of 3 feet; and at the left end by a Concrete wall the top of which will be 10.5 feet above the spillcrest, and have a top width of 2 feet.

18. The spillway is designed to safely discharge 10,000 cubic feet per second.

19. Pipes, sluice gates, etc., for flood discharge will be provided through the dam as follows:

A masonry culvert of 100 sq. feet net area during construction and one 34" pipe after dam is complete

20. What is the maximum height of flash boards which will be used on this dam? 2 feet

21. APRON. Below the proposed dam there will be an apron built of None feet long across the stream, ... feet wide and ..... feet thick.

22. Does this dam constitute any part of a public water supply? Yes

DEC

INSTRUCTIONS

Read carefully on the last page of this application the law setting forth the requirements to be complied with in order to construct or reconstruct a dam.

Each application for the construction or reconstruction of a dam must be made on this standard form, copies of which will be furnished upon request to the Chief Engineer, Division of Engineering, Department of Public Works, Albany, N. Y. The application must be accompanied by three sets of plans, and specifications. The information furnished must be in sufficient detail in order that the stability and safety of the dam can be determined. In cases of large and important dams assumptions made in calculating stresses and stability should be given.

Samples of materials to be used in the dam and of the material on which the dam is to be founded may be asked for, but need not be furnished unless requested.

If the dam constitutes a part of a public water supply, application should be made to the Water Power and Control Commission under Article XI of the Conservation Law.

An application for the construction or reconstruction of a dam must be signed by the prospective owner of the dam or his duly authorized agent. The address of the signer and the date must be given as provided for on the last page of the application form.

No. 10 Cannot understand this question. The banks are high above the proposed flow line everywhere, at least 25 feet above the spillway crest.

DEC

SECTION 948 OF THE CONSERVATION LAW

§ 948. **Structures for impounding water; inspection of docks; penalties.** No structure for impounding water and no dock, pier, wharf or other structure used as a landing place on waters shall be erected or reconstructed by any public authority or by any private person or corporation without notice to the superintendent of public works, nor shall any such structure be erected, reconstructed or maintained without complying with such conditions as the superintendent of public works may by order prescribe for safeguarding life or property against danger therefrom. No order made by the superintendent of public works shall be deemed to authorize any invasion of any property rights, public or private, by any person in carrying out the requirements of such order. The superintendent of public works shall have power, whenever in his judgment public safety shall so require, to make and serve an order directing any person, corporation, officer or board, constructing, maintaining or using any structure hereinbefore referred to, remove, repair or reconstruct the same within such reasonable time and in such manner as shall be specified in such order, and it shall be the duty of every such person, corporation, officer or board, to obey, observe and comply with such order and with the conditions prescribed by the superintendent of public works for safeguarding life or property against danger therefrom, and every person, corporation, officer or board failing, omitting or neglecting so to do, or who hereafter erects or reconstructs any such structure hereinbefore referred to without submitting to the superintendent of public works and obtaining his approval of plans and specifications for such structures when required so to do by his order or who hereafter fails to remove, erect or to reconstruct the same in accordance with the plans and specifications so approved shall forfeit to the people of this state a sum not to exceed five hundred dollars to be fixed by the court for each and every offense; every violation of any such order shall be a separate and distinct offense, and, in case of a continuing violation, every day's continuance thereof shall be and be deemed to be a separate and distinct offense. This section shall not apply to a dam where the area draining into the pond formed thereby does not exceed one square mile, unless the dam is more than ten feet in height above the natural bed of the stream at any point or unless the quantity of water which the dam impounds exceeds one million gallons; nor to a dock, pier, wharf or other structure under the jurisdiction of the department of docks, if any, in a city of over one hundred and seventy-five thousand population. This section as hereby amended shall not impair the effect of an order heretofore made by the conservation commission or commissioner under this section prior to the taking effect of chapter four hundred and nintey-nine of the laws of nineteen hundred and twenty-one, nor require the approval by the superintendent of public works of plans and specifications theretofore approved by such commission or commissioner under this section.

The foregoing information and accompanying plans and specifications are correct to the best of my knowledge and belief.

Village of Catskill, Owner.

By Chester M Everett, authorized agent of owner.

Address of signer 25 West 43d Street Date May 1, 1930

DEC

BENJAMIN L. SMITH
K. R. DELISLE
L. J. FITZPATRICK
R. H. LABERGE

BENJAMIN L. SMITH & ASSOCIATES
- Engineers -
ELEVEN NORTH PEARL STREET
ALBANY 7, NEW YORK
TELEPHONE HO 3-6125

WATERWORKS
SEWERAGE & INDUSTRIAL WASTES
DRAINAGE & HIGHWAYS
MUNICIPAL PLANNING
REPORTS - DESIGN - SUPERVISION

March 28, 1961.

Mr. Raymond I. Plank, Supt.,
Board of Water Commissioners,
Village of Catskill, New York.

Re: Catskill Storage Reservoir

Dear Ray:

We were pleased to receive your Order No. RP - 1070 dated March 23, 1961 with reference to the surveys and determinations made by us with respect to the actual capacity of the storage reservoir on Potuck Creek. As you mentioned, soundings were taken at that time, so that the actual volume could be computed and the size of the islands in the lake could be verified. From these surveys we plotted the elevations and provided contours. Our computations for each level of reservoir storage were forwarded to you, together with copies of a chart, entitled "Storage Capacity Curve - Impounding Reservoir." We are pleased to enclose herewith, Three (3) additional blue prints of this curve, as prepared in July 1958.

Confirming my conversation with you this morning, we shall prepare a finished map or tracing of the impounding reservoir, from which copies can be made and which will show graphically to a scale of 1" = 100', the outline and area of reservoir at flow line elevation 428; and under-water contours at 2-foot intervals for the entire area; the location and topography of the islands. On this contour map, we can identify the islands and can also forward to you, our computations on the extent to which the removal of one or more islands might increase the capacity of the reservoir.

Our previous letter to you of August 14, 1958, describes briefly the nature of this contour map and after we have forwarded to you prints of the completed drawing, you can let me know as to whether you wish us to retain the original tracing in our office or to forward it to you for your records.

With best personal regards.

Very truly yours,

BENJAMIN L. SMITH & ASSOCIATES,

BY: Benjamin L. Smith
Benjamin L. Smith

BLS:ljf
encl

OLDER

F3-43

BENJAMIN L. SMITH
K. R. DELISLE
L. J. FITZPATRICK
R. H. LABERGE

BENJAMIN L. SMITH & ASSOCIATES
- Engineers -
ELEVEN NORTH PEARL STREET
ALBANY 7, NEW YORK
TELEPHONE HO 3-6125

WATERWORKS
SEWERAGE & INDUSTRIAL WASTES
DRAINAGE & HIGHWAYS
MUNICIPAL PLANNING
REPORTS - DESIGN - SUPERVISION

April 4, 1961.

Mr. Raymond I. Plank, Supt.,
Board of Water Commissioners,
Village of Catskill, N. Y.

Dear Ray:

Confirming our previous letter of March 28, 1961, we have prepared and completed a finished map of the Catskill Water Storage Reservoir entitled, "Topographic Map of Impounding Reservoir." This map shows graphically to a scale 1" = 100'; the outline and area of the reservoir at flow line elevation 428; under-water contours at 2-foot intervals for the entire area; the location and under-water topography of each of the five islands, designated as A, B, C, D and E; the net water surface area of the reservoir at flashboard elevation 428; and the area of the island at this same level.

We are enclosing herewith, three copies each of tabulations entitled "Volume of Islands below Flashboard Elevation 428 in cubic yards" and "Water Storage displaced by Islands below Elevation 428 in million gallons." You will note from these tabulations, the relative amounts of water storage displaced by each island expressed in million gallons and also the amount of material below elevation 428 which would require removal in order to obtain this additional volume. The storage capacity curve of July 1958 indicates a present usable storage between elevation 406 and elevation 428 in the amount of 246.58 million gallons, whereas, the volume occupied by these islands, as shown on the enclosed tabulation is approximately 17 million gallons, or roughly 7% of the reservoir capacity.

Under separate cover, we are forwarding to you three black and white print copies of the topographic map. The original tracing can also be forwarded to you if you so desire, or can be retained in our office at your option. We would be pleased to discuss with you any matters relating to the Catskill water supply which you may have under consideration and should like to thank you for the opportunity of preparing this map.

With best personal regards.

Very truly yours,

BENJAMIN L. SMITH & ASSOCIATES,

BY: Benj. L. Smith
Benjamin L. Smith

BLS:ljf
encls.

OWNER

F3-44

BENJAMIN L. SMITH & ASSOCIATES
~ Engineers ~

March 31, 1961.

VILLAGE OF CATSKILL, NEW YORK

POTUCK CREEK SUPPLY

VOLUME OF ISLANDS BELOW FLASHBOARD ELEV. 428

IN CUBIC YARDS

Range of Levels	Island A	Island B	Island C	Total A, B & C	Island D	Island E
428 - 426	2,500	1,800	7,700	12,000	4,500	1,300
428 - 424	5,700	4,200	16,500	26,400	9,600	
428 - 422	9,600	7,200	26,500	43,300	15,200	
428 - 420	14,200	11,000	37,900	63,100	21,500	

OLSWER

BENJAMIN L. SMITH & ASSOCIATES
~ Engineers ~

March 31, 1961.

VILLAGE OF CATSKILL, NEW YORK

POTUCK CREEK SUPPLY

WATER STORAGE DISPLACED BY ISLANDS BELOW ELEV. 428

IN MILLION GALLONS

Range of Levels	Island A	Island B	Island C	Total A, B & C	Island D	Island E
428 - 426	0.506	0.367	1.551	2.424	0.911	0.275
428 - 424	1.147	0.851	3.337	5.335	1.931	
428 - 422	1.937	1.456	5.360	8.753	3.077	
428 - 420	2.870	2.225	7.650	12.745	4.343	

OLDNER

CATSKILL (V)

WATER SUPPLY REPORT

November 1971

By: Daniel W. Stone
Assistant Sanitary Engineer
Division of Sanitary Engineering
Bureau of Public Water Supply
Water Supply Plant Operations Section

DoH

F3-47

Potic Reservoir Source

Catskill receives its raw water from Potic reservoir, a man made impoundment of 250 mg with a surface area of 576 acres. The drainage basin of 14.5 sq. miles is comprised primarily of woodlands with some agricultural and residential lands.

A reinforced concrete intake structure is located at the face, of the dam. The intake was designed with provision for obtaining wate· from 1 of 3 reservoir levels. The lowest level opening is the only one that has been used for at least the past 10 years and probably much longer. (At least since Mr. Clearwater has been involved with the water treatment plant). The valve for the lowest intake has remained open continuously while the others remained closed. It is probable, because of the lack of use of these valves, that operation of them at this time is impossible. Mr. Clearwater is therefore compelled to take water from the lowest part of the reservoir when the water quality from a higher level might be better. A detailed study of the engineering plans for the construction of the intake structure should be made to ascertain how water can be routed from the middle or top level when the lowest level is shut off. After this has been determined it will be safe to try to close the valve for the lowest level. If the valve works, this would enable Mr. Clearwater to select the level of the reservoir which has the best water quality at any given time. If it freezes shut or partially open he has the ability to take water from one of the other levels until the valve can be repaired.

Under quiescent conditions a body of water tends to stratify into distinct temperature zones. In the winter the upper most layer (epilimnion) will contain the coldest water with the surface frozen. As the depth increases the temperature gradually increases to approximately 39.4 degrees F. at the bottom.

The lowest layer is normally devoid of oxygen and anerobic digestion may occur producing foul taste and odors. Also the pH maybe low enough to desolve relatively large quantities of iron and manganese. These properties would render the water unsatisfactory aesthetically. It is advisable to drain this lower layer from the reservoir (when an abundant supply of water is available) before the spring turnover occurs.

My review of the plans for the intake structure indicates a drainage pipe was installed when the dam was constructed. Mr. Clearwater and I tried to verify this be examining the intake tunnel. Unfortunately the tunnel contained approximately 3 feet of water which made it impassable. If the drain was installed as indicated on the plans and the valve can be located and made to operate this would enable Mr. Clearwater to drain the bottom layer of the reservoir before the spring turnover occurs, ridding the reservoir of some of the poor water quality before mixing occurs.

The dam has been neglected and is in need of maintenance. Trees growing on the top of the dam should be removed and this area should be moxed to prevent recurring growths. The spillway is spalling severely and is in need of grouting or pointing up.

DOH

Potic Reservoir Source - Cont'd

The pipes supporting the flash board should be inspected and those that are rotten or generally in poor condition should be replaced.

Mr. Clearwater was provided with an aluminum boat and motor to enable him to apply copper sulfate to the reservoir. Mr. Clearwater will have to rinse the boat thoroughly after each copper sulfate application. If copper sulfate crystals are left in the boat electriclytic cells will be set up between the copper crystals and the aluminum and in a very short time corrosion will make small holes in the boat.

If algae blooms within the reservoir present a problem,in the future, Mr. Clearwater should concentrate the copper sulfate application in the restricted areas or small bays of the reservoir. Due to the low natural alkalinity it is believed that a 0.3 parts per million copper sulfate application will be sufficient to destroy most algae froms in Potic Creek Reservoir. It is therefor recommended that copper sulfate treatment be applied at 0.3 ppm. If an 85 - 90% reduction in algae concentration is not acheived the copper sulfate addition should be increased to 0.5 ppm. The copper sulfate can be added by trailing a burlap bag containing a pre measured ammount of copper sulfate crystals behind the boat and moving in a criss cross manner across the above mentioned bays and restricted areas.

The New York State Commissioner of Health enacted Rules and Regulations for the protection from contamination of the public water supply of the Village of Catskill in November of 1930. (a copy is attached). The Village does not employ a watershed inspector and therefore does not use this legal means to its fullest for the protection of Potic Creek Reservoir. Mr. Clearwater is responsible for any inspection made along with the other duties of operating the treatment plant. The area of Potic Creek Reservoir was well posted at the time of my inspection to fishing, hunting and trespassing. Several areas on the watershed had been used for local dumping. These areas should be cleaned up and signs placed "No Dumping Allowed". In the future, if a watershed inspector is hired, better patrol of the reservoir grounds may reduce this illegal dumping problem.

Section 21 of the Rules and Regulations requires that "The Board of Water Commissioners of the Village of Catskill or such other Boards... as maybe charged with maintenance... of the public water supply shall make regular and thorough inspections... and shall report annually, on the 1st day of January, the results of the regular inspection made during the preceeding year". It is essential that the inspection of the entire watershed be made to properly maintain the quality of this important water resource.

In view of present day concern for toxic chemicals, radioactive materials, pesticides and herbicides it is strongly recommended that the Rules and Regulations of 1930 be updated using the attached model Rules and Regulations as a guide.

DOH

FEE DAM INSPECTION REPORT

RB	CTY	YR AP.	209 DAM NO.	INS. DATE	USE	TYPE
01	20	30	00081 0	09 14 72	003	2

AS BUILT INSPECTION

1	Location of Sp'way and outlet	1	Elevations
1	Size of Sp'way and Outlet	1	Geometry of Non-overflow section

1 GENERAL CONDITION OF NON-OVERFLOW SECTION

1	Settlement	1	Cracks	1	Deflection
1	Joints	2	Surface of Concrete	1	Leakage
1	Undermining	1	Settlement of Embankment	1	Crest of Dam
2	Downstream Slope Trees	2	Upstream Slope Trees	1	Toe of Slope

1 GENERAL COND. OF SP'WAY AND OUTLET WORKS

4	Auxiliary Spillway	1	Service or Concrete Sp'way	1	Stilling Basin
1	Joints	2	Surface of Concrete	2	Spillway Toe (starting To deteriorate)
1	Mechanical Equipment	1	Plunge Pool	1	Drain

1	Maintenance	B	Hazard Class
3	Evaluation	B	Inspector

COMMENTS:

Large impoundment but spillway is only about 6' high on solid rock (shale) 3' flashboards on concrete OG Spillway

DEC

DEC DAM INSPECTION REPORT CODING

1. River Basin - Nos. 1-23 on Compilation Sheets
2. County - Nos. 1-62 Alphabetically
3. Year Approved -
4. Inspection Date - Month, Day, Year
5. Apparent use -
   1. Fish & Wildlife Management
   2. Recreation
   3. Water Supply
   4. Power
   5. Farm
   6. No Apparent Use
6. Type -
   1. Earth with Aux. Service Spillway
   2. Earth with Single Conc. Spillway
   3. Earth with Single non-conc. Spillway
   4. Concrete
   5. Other
7. As-Built Inspection - Built substantially according to approved plans and specifications

Location of Spillway and Outlet Works

1. Appears to meet originally approved plans and specifications.
2. Not built according to plans and specifications and location appears to be detrimental to structure.
3. Not built according to plans and specifications but location does not appear to be detrimental to structure.

Elevations

1. Generally in accordance to approved plans and specifications as determined from visual inspection and use of hand level.
2. Not built according to plans and specifications and elevation changes appear to be detrimental to structure.
3. Not built according to plans and specifications but elevation changes do not appear to be detrimental to structure.

Size of Spillway and Outlet Works

1. Appears to meet originally approved plans and specifications as determined by field measurements using tape measure.
2. Not built according to plans and specifications and changes appear detrimental to structure.
3. Not built according to plans and specifications but changes do not appear detrimental to structure.

Geometry of Non-overflow Structures

1. Generally in accordance to originally approved plans and specifications as determined from visual inspection and use of hand level and tape measure.
2. Not built according to plans and specifications and changes appear detrimental to structure.
3. Not built according to plans and specifications but changes do not appear detrimental to structure.

General Conditions of Non-Overflow Section

1. Adequate - No apparent repairs needed or minor repairs which can be covered by periodic maintenance.
2. Inadequate - Items in need of major repair.

(Items) For boxes listed on condition under non-overflow section.
1. Satisfactory.
2. Can be covered by periodic maintenance.
3. Unsatisfactory - Above and beyond normal maintenance.

DEC

DEC DAM INSPECTION REPORT CODING (cont.)

General Condition of Spillway and Outlet Works

1. Adequate - No apparent repairs needed or minor repairs which can be covered by periodic maintenance.
2. Inadequate - Items in need of major repair.

(Items) For boxes listed conditions listed under spillway and outlet works.

1. Satisfactory.
2. Can be covered by periodic maintenance.
3. Unsatisfactory - Above and beyond normal maintenance.
4. Dam does not contain this feature.

Maintenance

1. Evidence of periodic maintenance being performed.
2. No evidence of periodic maintenance.
3. No longer a dam or dam no longer in use.

.S.)

Hazard Classification Downstream

1. (A) Damage to agriculture and county roads.
2. (B) Damage to private and/or public property.
3. (C) Loss of life and/or property.

Evaluation - Based on Judgment and Classification in Box Nos.

Evaluation for Unsafe Dam

1. Unsafe - Repairable.
2. Unsafe - Not Repairable.
3. Insufficient evidence to declare unsafe.

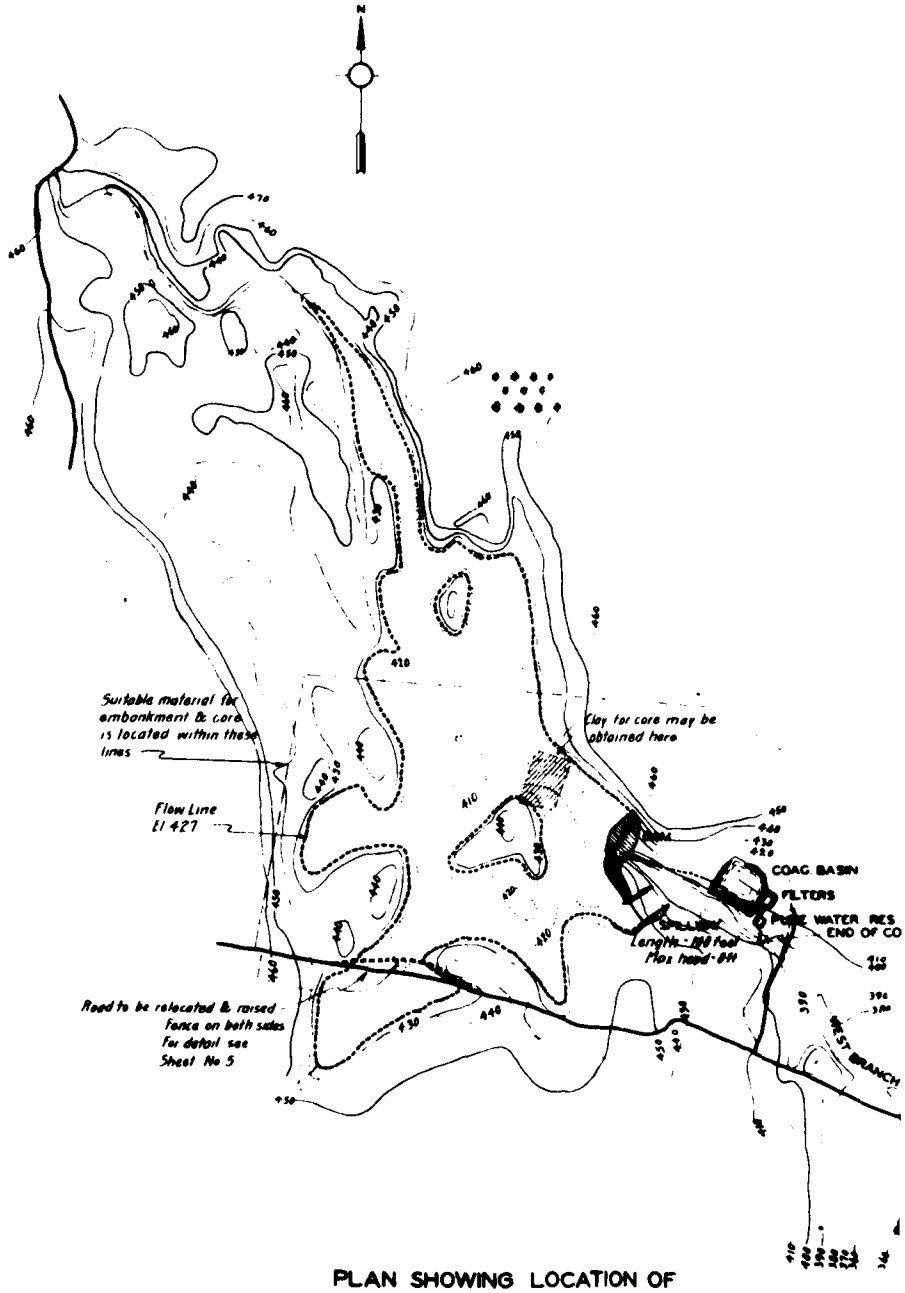
River Basins	Counties	
(1) LOWER HUDSON	1 Albany	56 Orange.
(2) UPPER HUDSON	2 Allegany	57 Orleans
(3) MOHAWK	3 Bronx	58 Oswego
(4). LAKE CHAMPLAIN	4 Broome	59 Otsego
(5) DELAWARE	5 Cattaraugus	60 Putnam
(6) SUSQUEHANNA	6 Cayuga	61 Queens
(7) CHEMUNG	7 Chautauqua	62 Rensselaer
(8) OSWEGO	8 Chemung	63 Richmond
(9) GENESEE	9 Chenango	64 Rockland
(10) ALLEGHENY	10 Clinton	65 St. Lawrence
(11) LAKE ERIE	11 Columbia	66 Saratoga
(12) WESTERN LAKE ONTARIO	12 Cortland	67 Schenectady
(13) CENTRAL LAKE ONTARIO	13 Delaware	68 Schoharie
(14) EASTERN LAKE ONTARIO	14 Dutchess	69 Schuyler
(15) SALMON RIVER	15 Erie	70 Seneca
(16) BLACK RIVER	16 Essex	71 Steuben
(17) WEST ST. LAWRENCE	17 Franklin	72 Suffolk
(18) EAST ST. LAWRENCE	18 Fulton	73 Sullivan
(19) RACQUETTE RIVER	19 Genesee	74 Tioga
(20) ST. REGIS RIVER	20 Greene	75 Tompkins
(21) HOUSATONIC	21 Hamilton	76 Ulster
(22) LONG ISLAND	22 Herkimer	77 Warren
(23) OSWEGATCHIE	23 Jefferson	78 Washington
(24) GLASSE	24 Kings	79 Wayne
	25 Lewis	80 Westchester
	26 Livingston	81 Wyoming
	27 Madison	82 Yates
	28 Monroe	
	29 Montgomery	
	30 Nassau	
	31 New York	
	32 Niagara	
	33 Oneida	
	34 Onondaga	
	35 Ontario	

DEC

APPENDIX G

DRAWINGS

TABLE OF CONTENTS



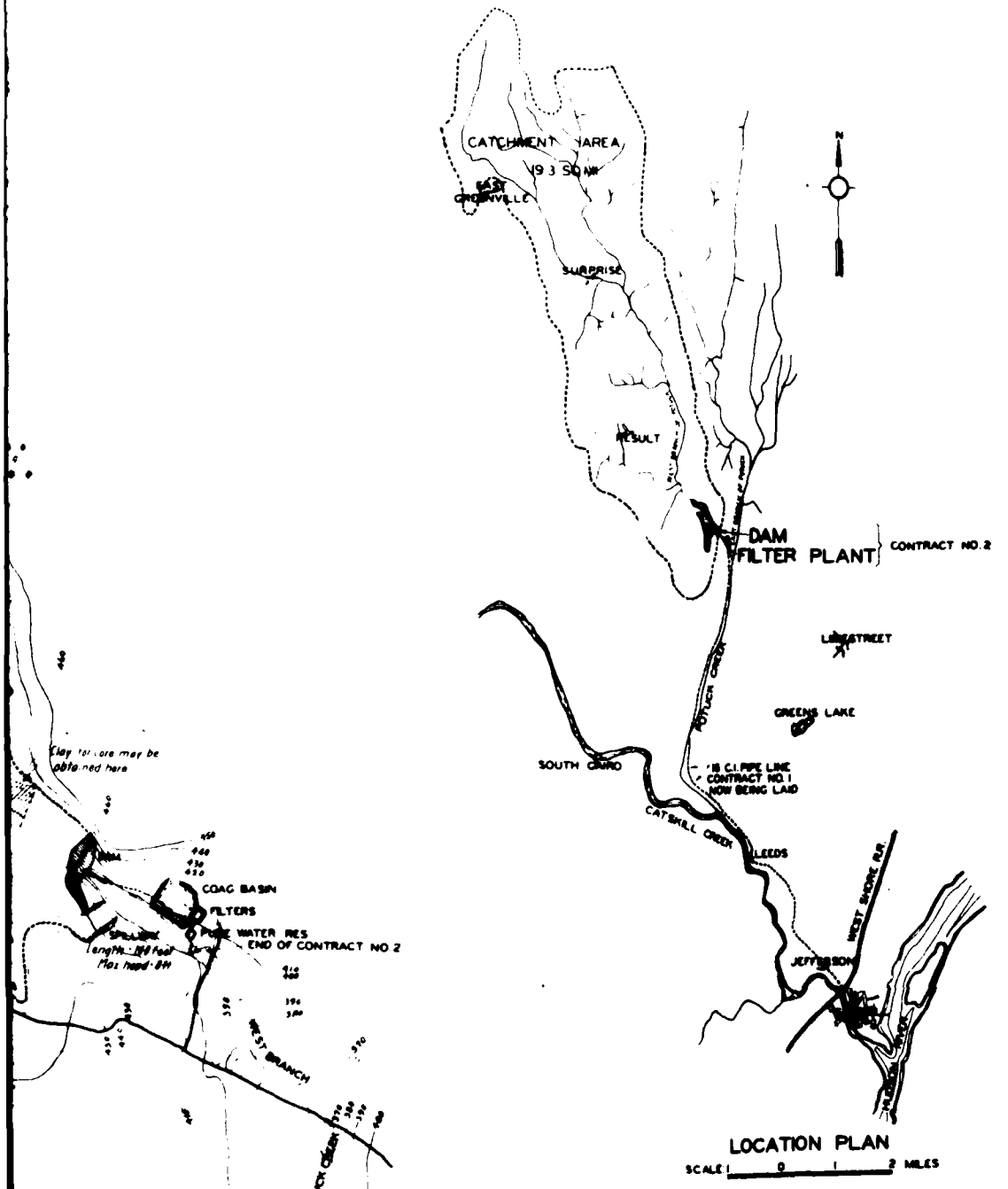
PLAN SHOWING LOCATION OF BORROW PITS

SCALE 400 0 400 800 FEET

Hazen & Everett
Civil Engineers
29 W 45th St N.Y. City
April 29, 1930

FROM OWNER
REDUCED TO 77% OF ORIGINAL

SHEET NO. 1



LOCATION PLAN

SCALE 0 1 2 MILES

CATION OF
NTS

800 FEET

2

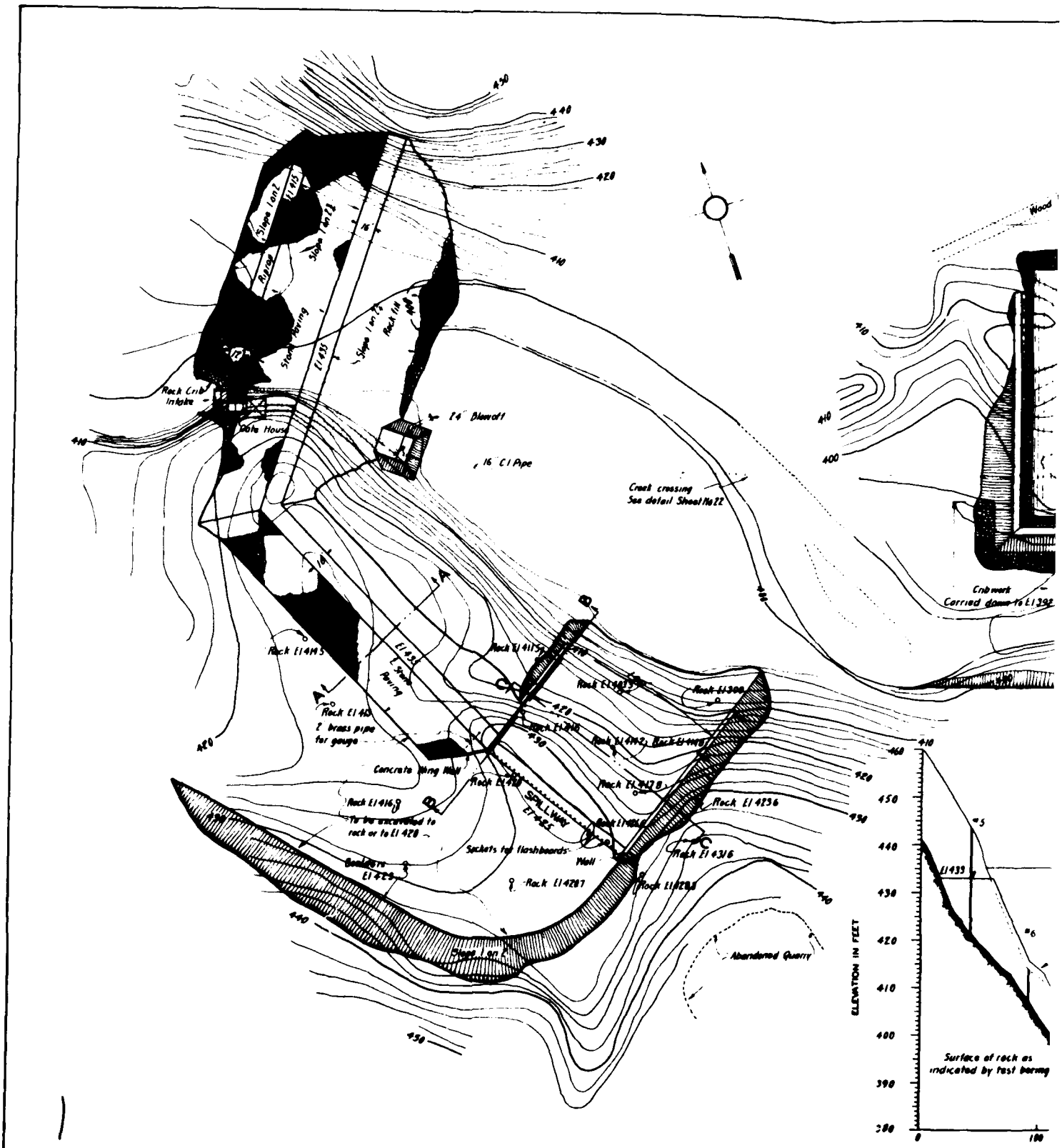
CATSKILL WATER WORKS
POTUCK CREEK SUPPLY
CONTRACT NO. 2
DAM & FILTER PLANT

GENERAL PLAN

SCALES AS INDICATED

Charles M. Burdett
CONSULTING ENGINEER

G-1 CTM DWG NO. 81-100



Hazen & Everett
Civil Engineers
25 W 43rd St N.Y City
April 25, 1930

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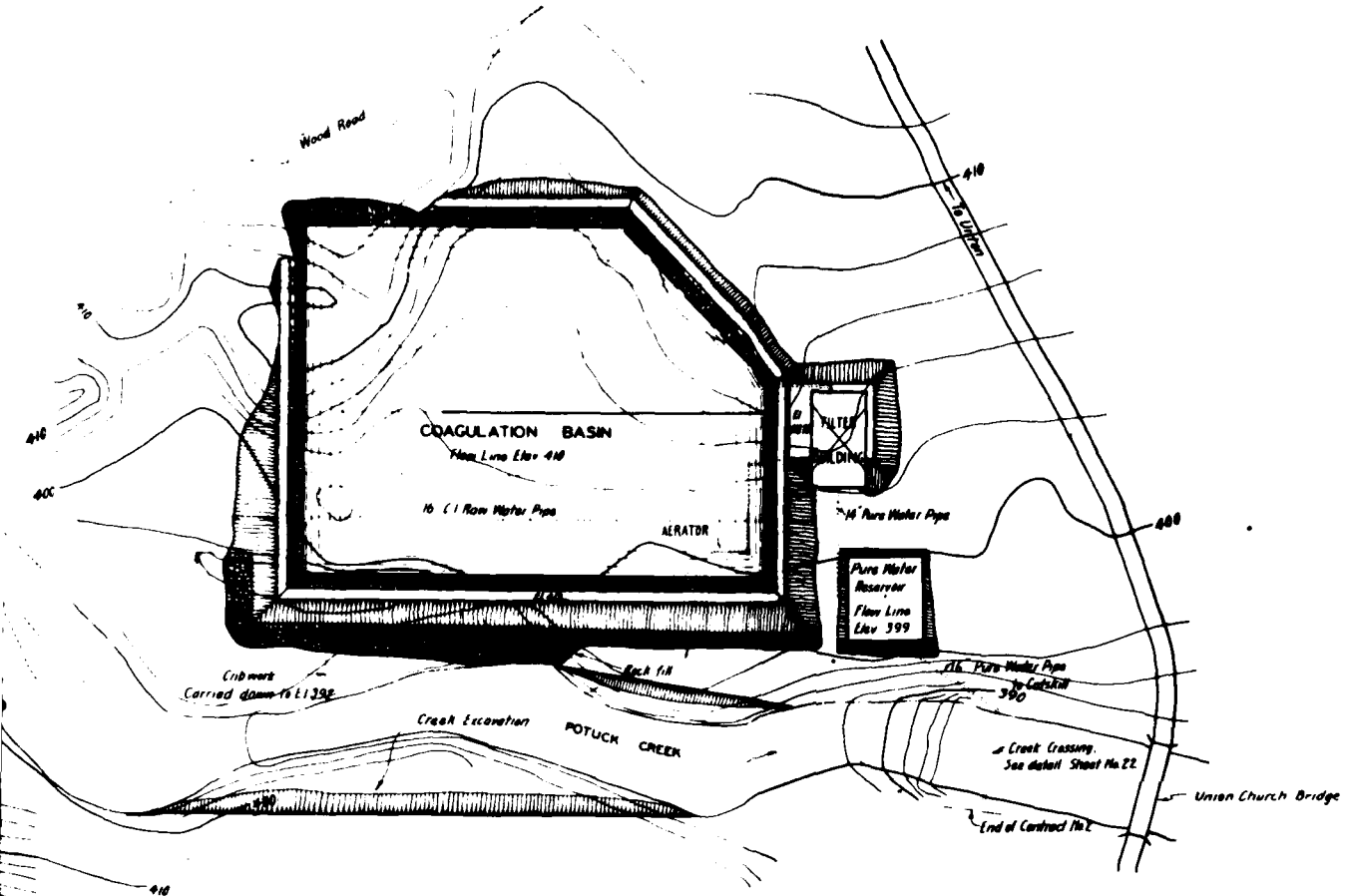
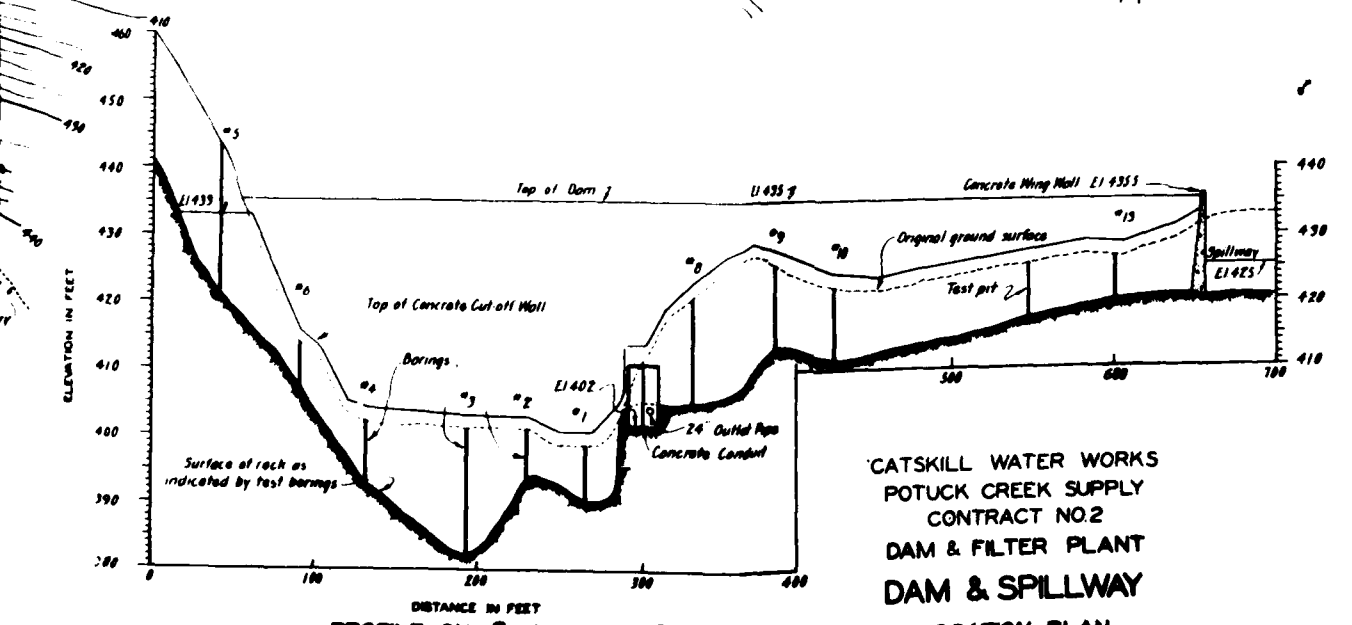




PROFILE ON ℄ OF DAM 2

CATSKILL WATER WORKS
POTUCK CREEK SUPPLY
CONTRACT NO.2
DAM & FILTER PLANT

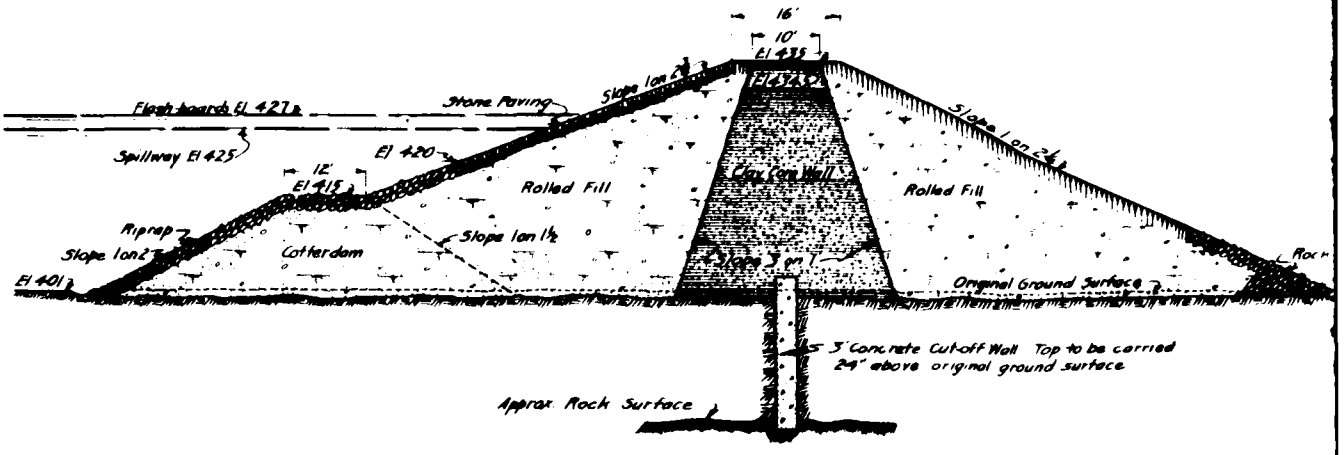
DAM & SPILLWAY

LOCATION PLAN

SCALE: 40 0 40 80 FEET

Charles M Everett
CONSULTING ENGINEER

G-2 CTM DWG NO. 81-100



TYPICAL SECTION OF DAM

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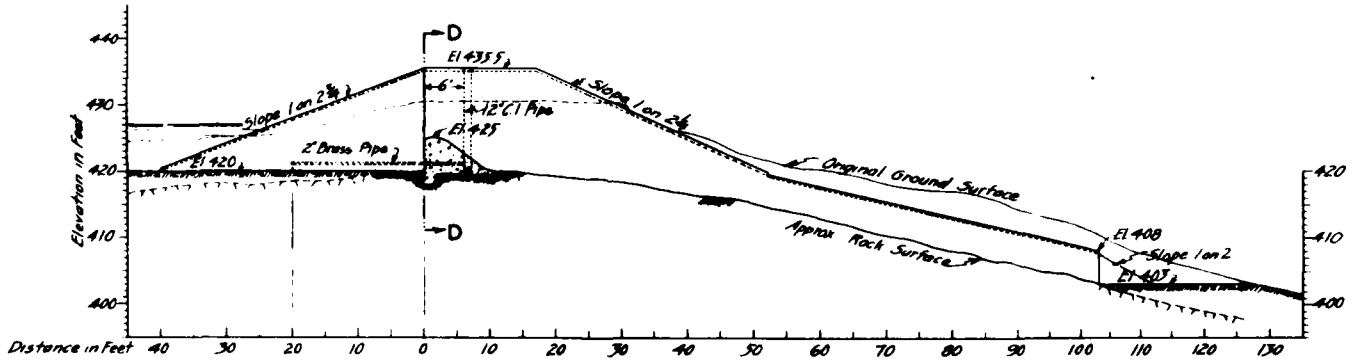

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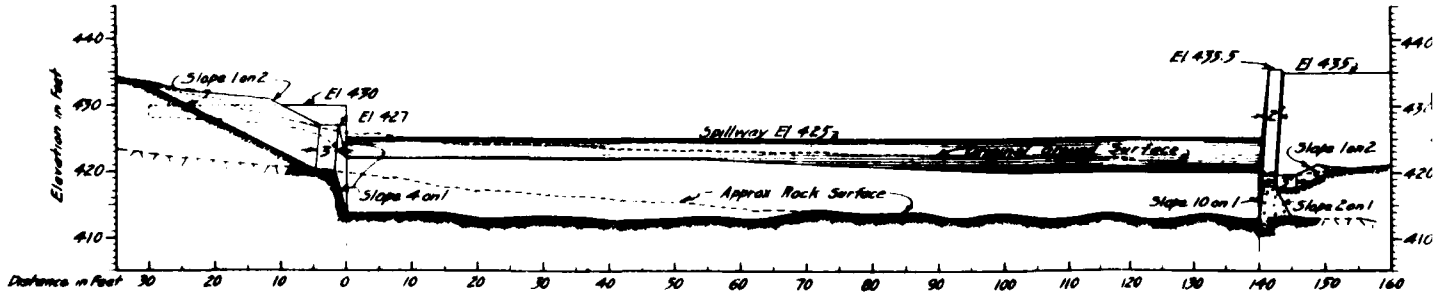
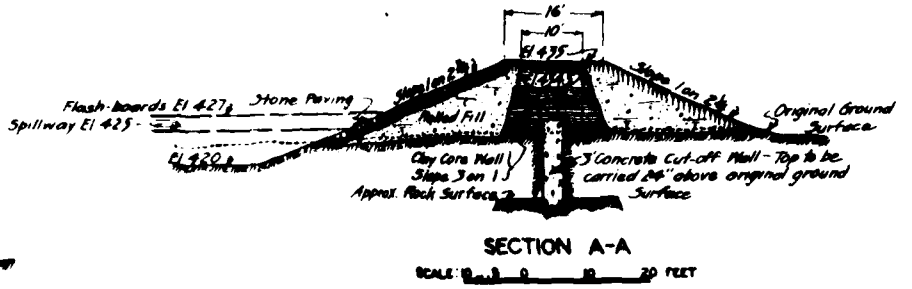


SECTION C-C

Mazen & Everett
Civil Engineers
25 W 43rd St N Y City
April 29, 1938

FROM OWNER
REDUCED TO 77% OF ORIGINAL



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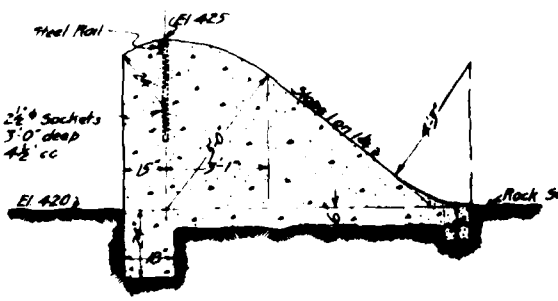

TYPICAL SPILLWAY SECTION

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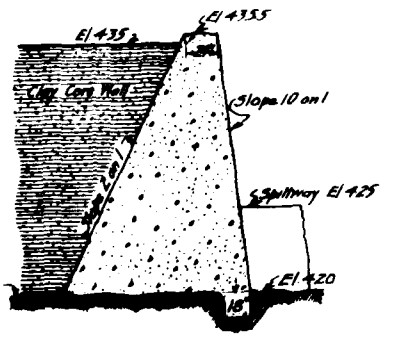

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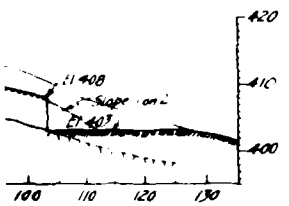

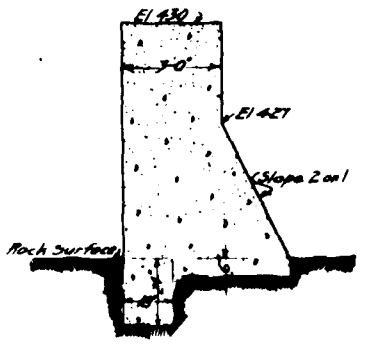

WALL SECTION AT SOUTH END OF SPILLWAY

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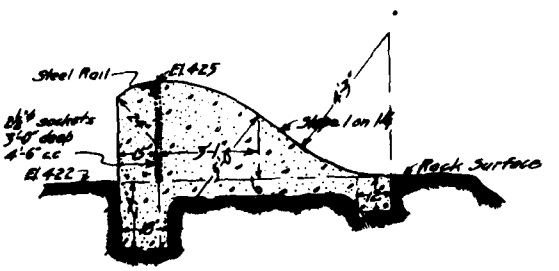

MINIMUM SPILLWAY SECTION

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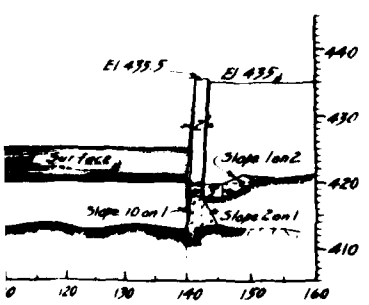


CATSKILL WATER WORKS
POTUCK CREEK SUPPLY
CONTRACT NO 2
DAM & FILTER PLANT

DAM & SPILLWAY

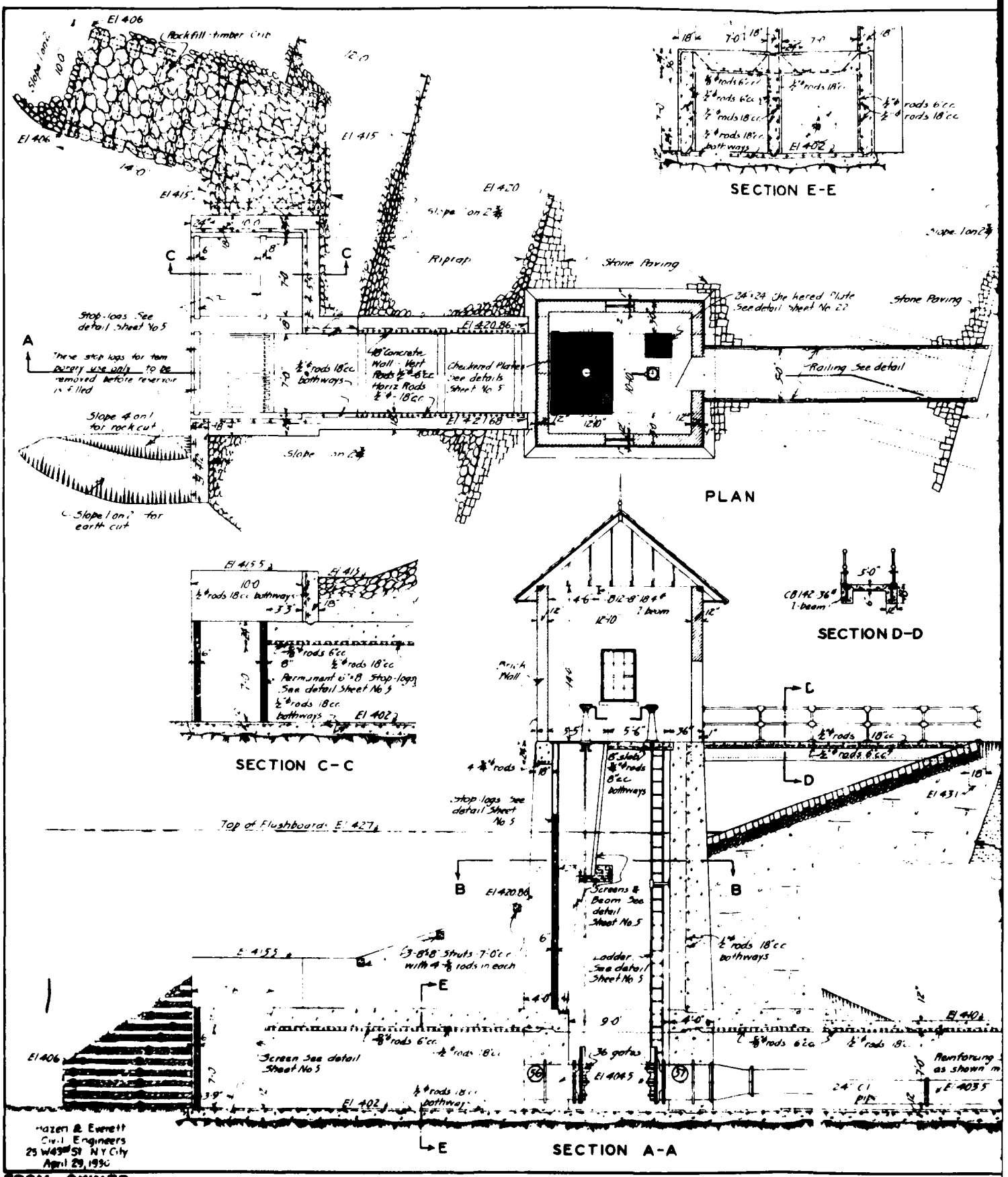
SECTIONS

SCALES AS INDICATED

2

COMMISSIONER

G-3 CTM DWG NO. 81-100



FROM OWNER
REDUCED TO 77% OF ORIGINAL

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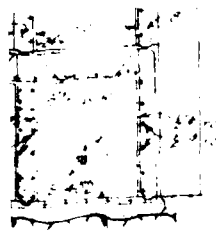

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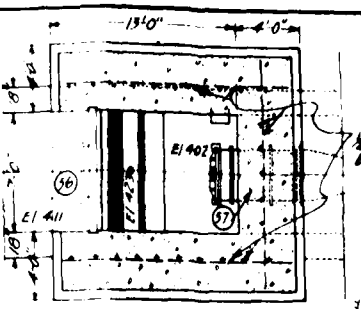

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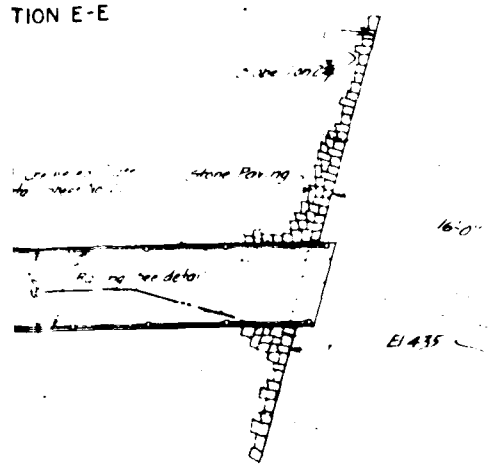

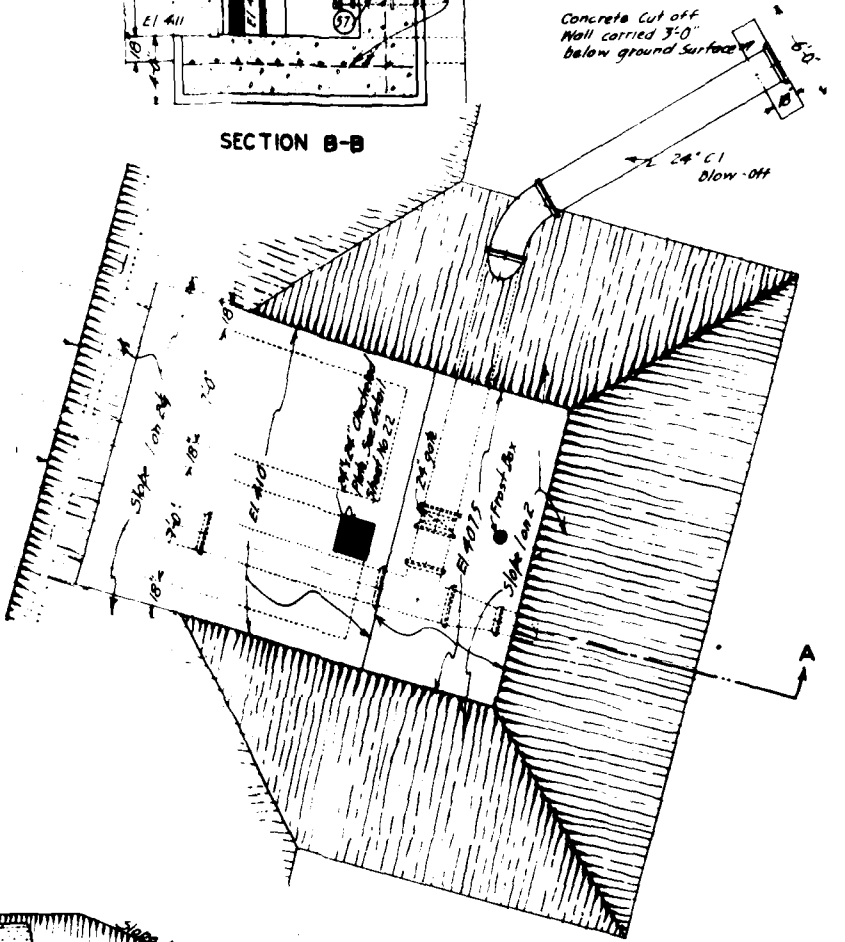

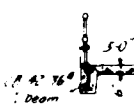

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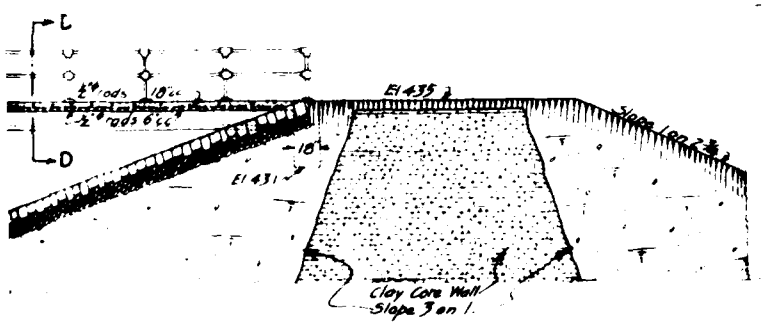
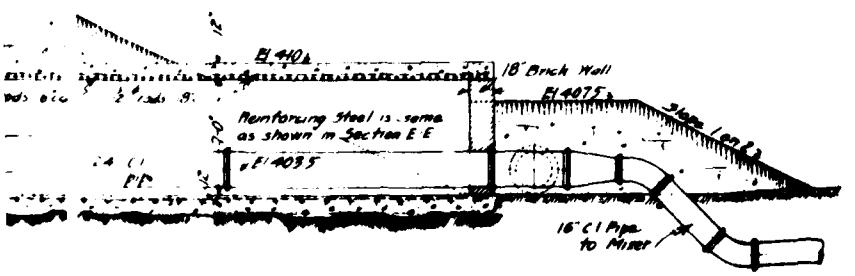


2



CATSKILL WATER WORKS
POTUCK CREEK SUPPLY
CONTRACT NO.2
DAM & FILTER PLANT

GATE HOUSE

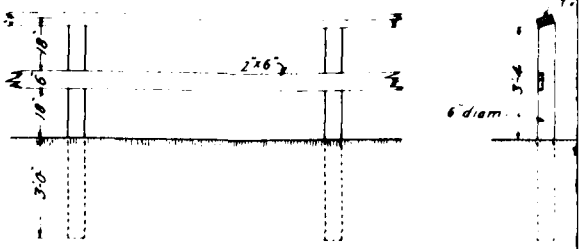
PLAN AND SECTIONS

SCALE: 1 0 2 4 8 FEET

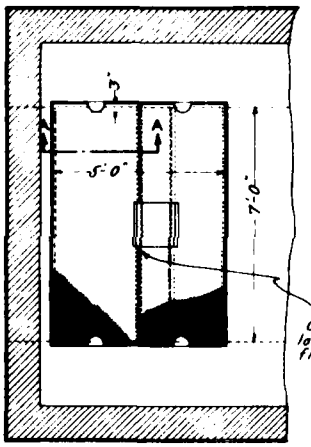
Charles M. Brandt
CONSULTING ENGINEER

G-4 CTM DWG NO. 81-100

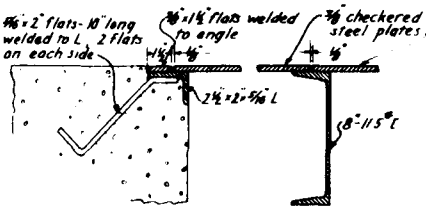
SECTION OF ROAD TO BE RAISED
SCALE 10 0 10 20 FEET



DETAIL OF GUARD RAIL
SCALE 2 0 2 4 FEET

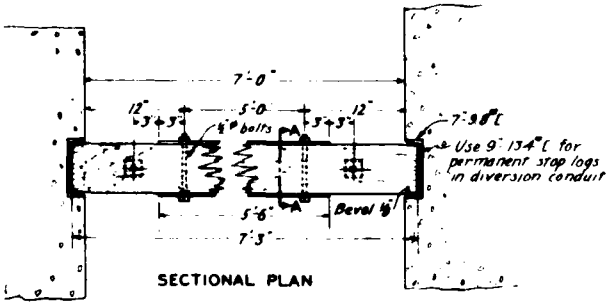


PLAN
SCALE 2 0 2 4 FEET

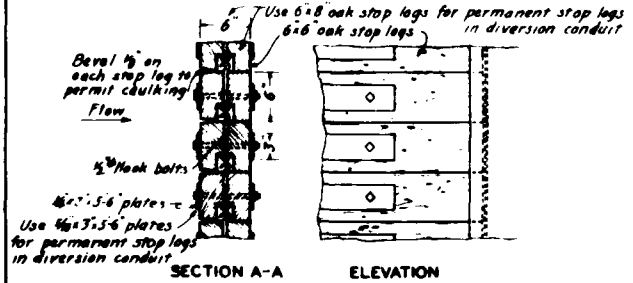


SECTION A-A
SCALE 4 0 4 8 INCHES

DETAIL OF FLOOR PLATE

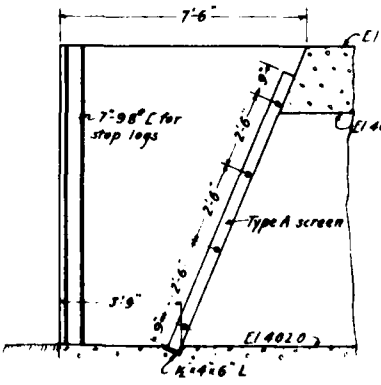


SECTIONAL PLAN



SECTION A-A ELEVATION

DETAIL OF STOP LOGS
SCALE 6 4 0 8 16 INCHES

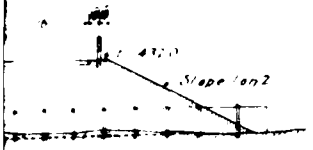


SECTION THRU
SCALE 2 0

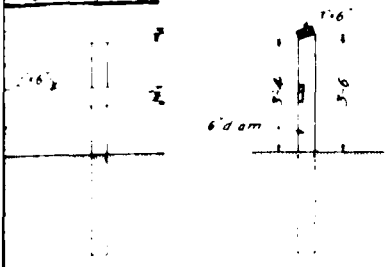
Hazen & Everett
Civil Engineers
25 W 43rd St. N.Y. City
April 29, 1930

FROM OWNER
REDUCED TO 77% OF ORIGINAL

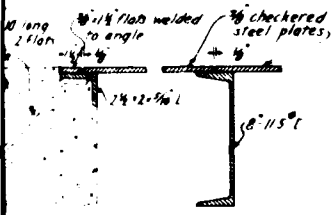
SHEET NO. 5



OF ROAD TO BE RAISED
0 10 20 FEET

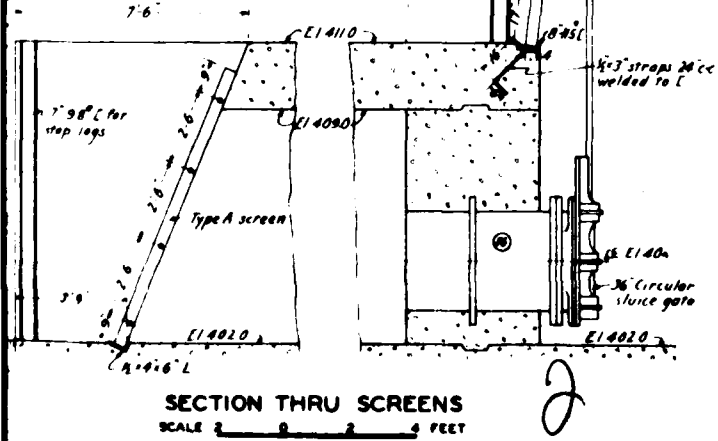


IL OF GUARD RAIL
0 2 4 FEET

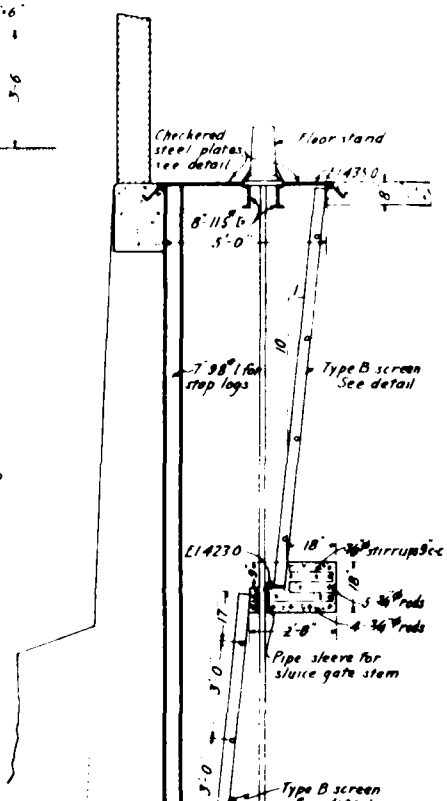


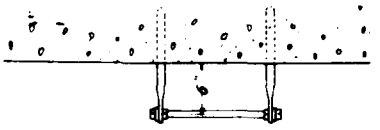
SECTION A-A
ALE 4 0 4 8 INCHES

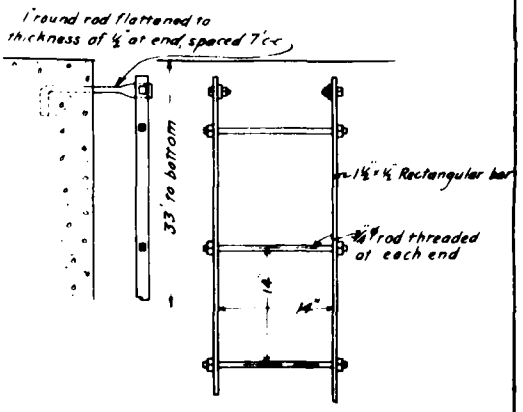
OR PLATE



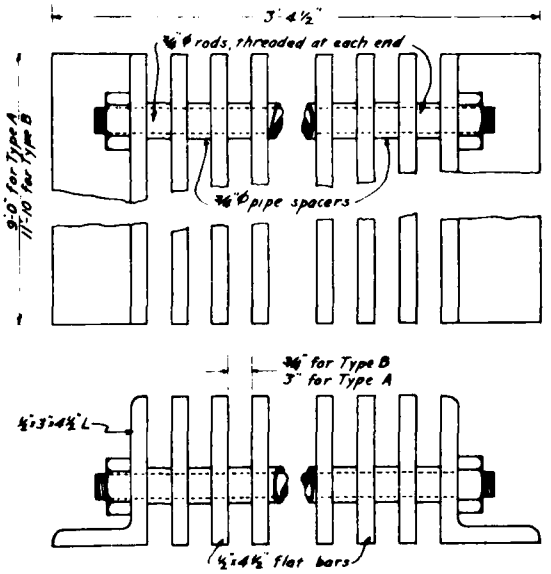
SECTION THRU SCREENS
SCALE 2 0 2 4 FEET







DETAIL OF LADDER
SCALE 8 4 0 8 12 INCHES



DETAIL OF SCREENS
SCALE 2 0 2 4 INCHES
TYPE A - - - - - 2 REQUIRED
TYPE B - - - - - 4 REQUIRED

CATSKILL WATER WORKS
POTUCK CREEK SUPPLY
CONTRACT NO.2
DAM & FILTER PLANT

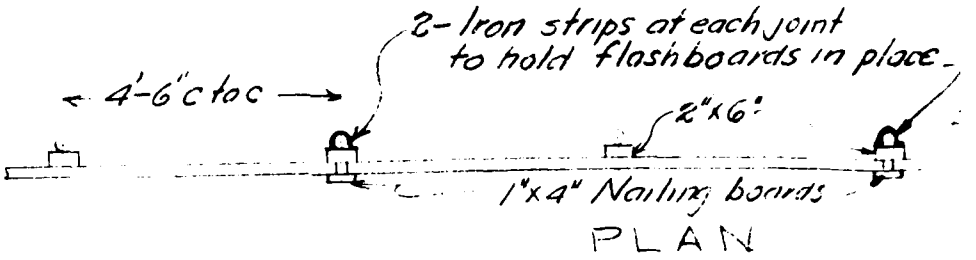
GATE HOUSE

DETAILS

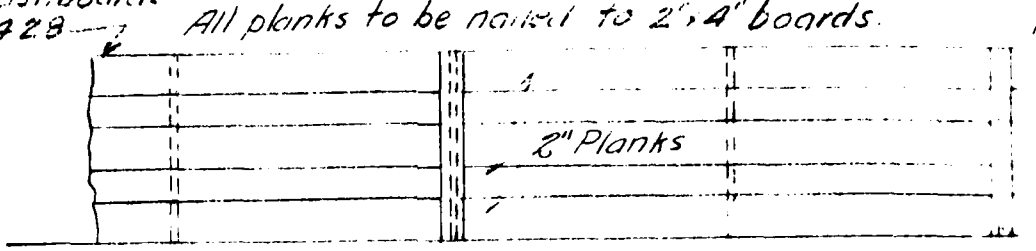
SCALES AS INDICATED

CONSULTING ENGINEER

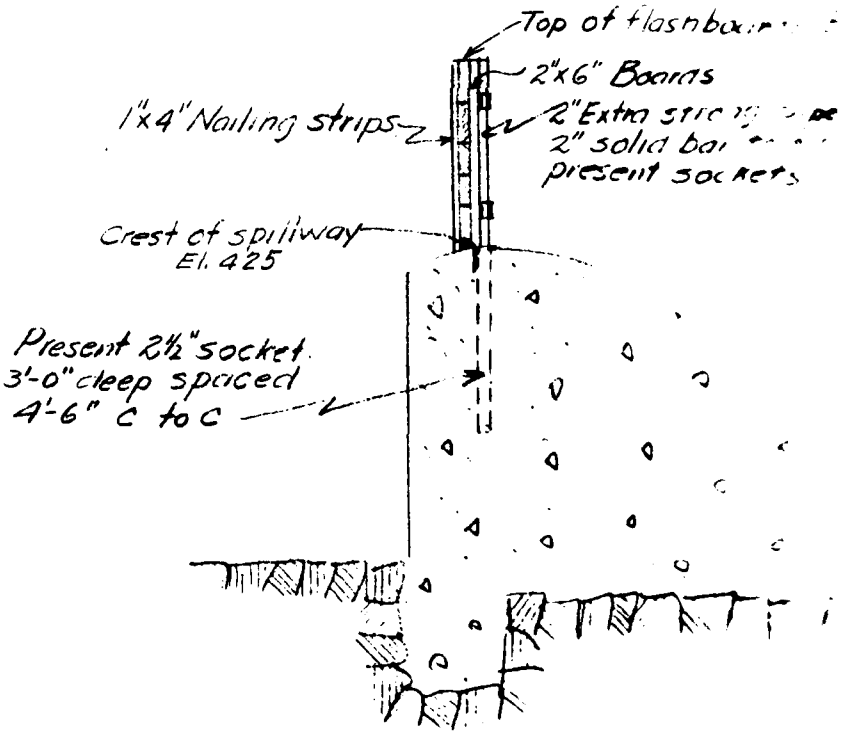
G-5 CTM DWG NO. 81-100



PLAN



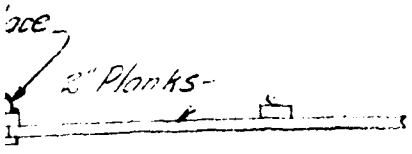
ELEVATION

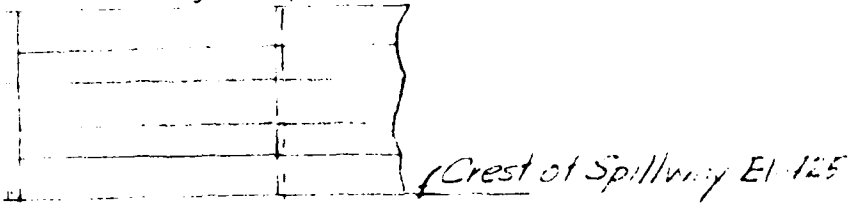


SECTION

Hazen & Everett
Civil Engineers
25 W 43rd St NY City
Feb 19 1931.

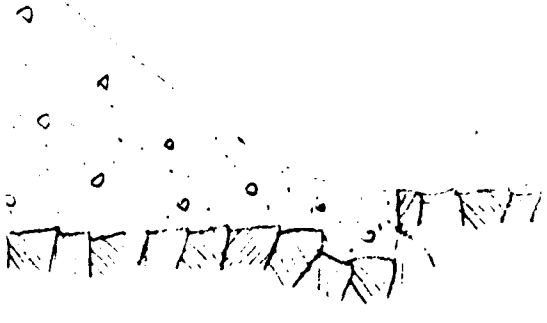
FROM OWNER
REDUCED TO 72% OF ORIGINAL





nboards El 428

ns
tiong pipe or
bar to fit in
sockets



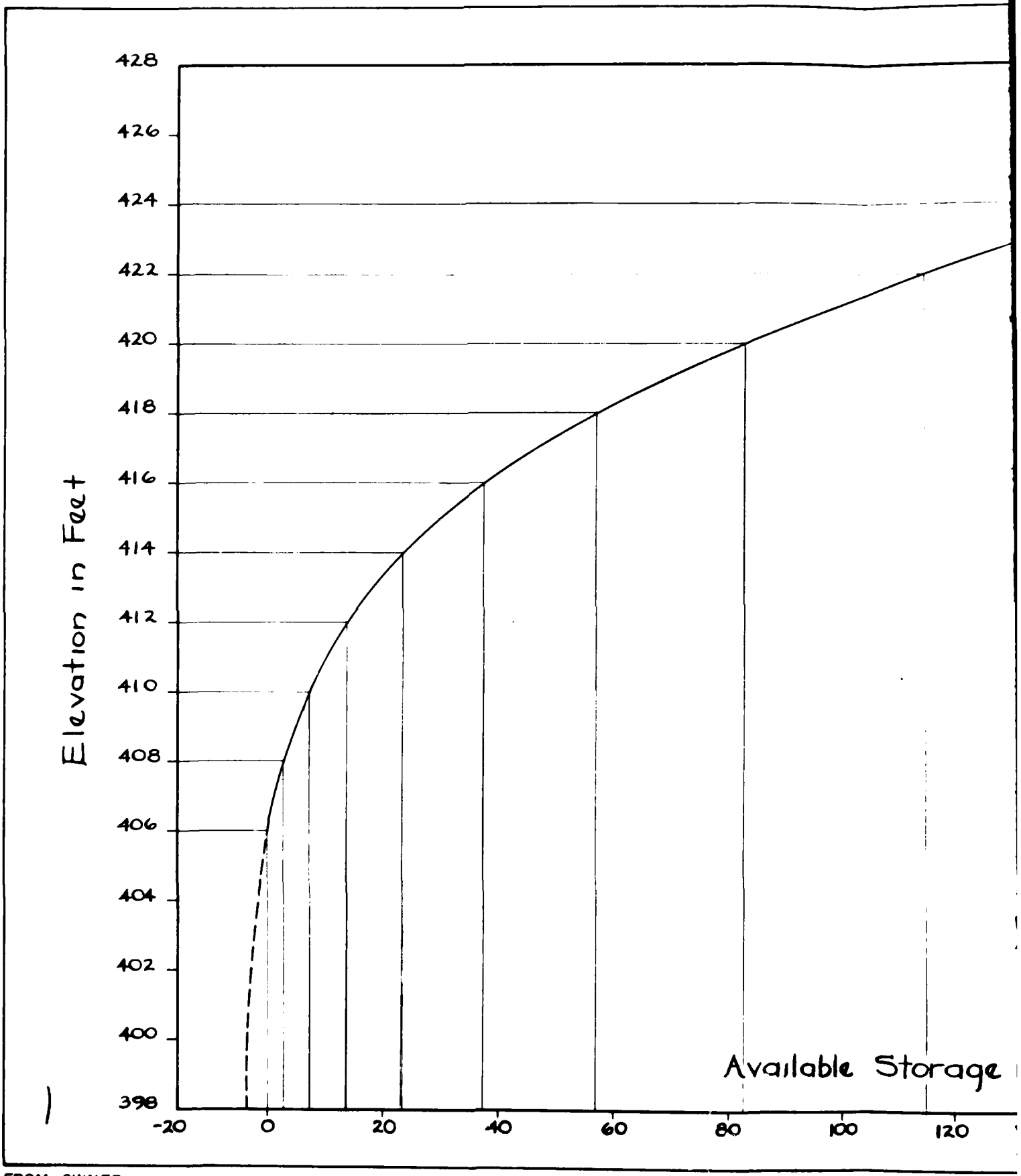
CATSKILL WATER WORKS
POTUCK CREEK SUPPLY
FLASHBOARD DETAILS
Scale 1" = 2'

2

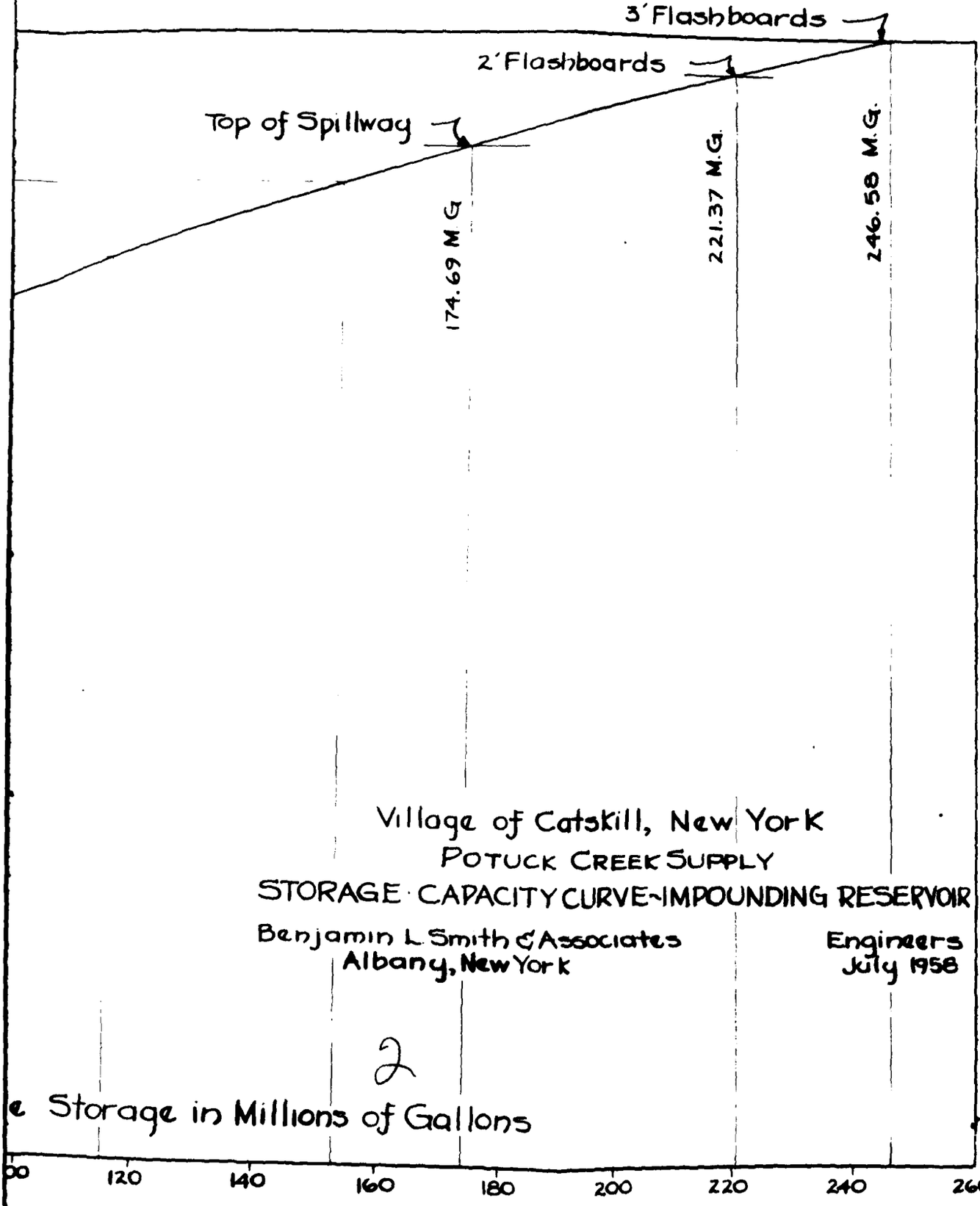
3111
ARL

G-6

CTM DWG NO. 81-100


428
426
424
422
420
418
416
414
412
410
408
406
404
402
400
398
Elevation in Feet
-20
0
20
40
60
80
100
120
Available Storage

FROM OWNER



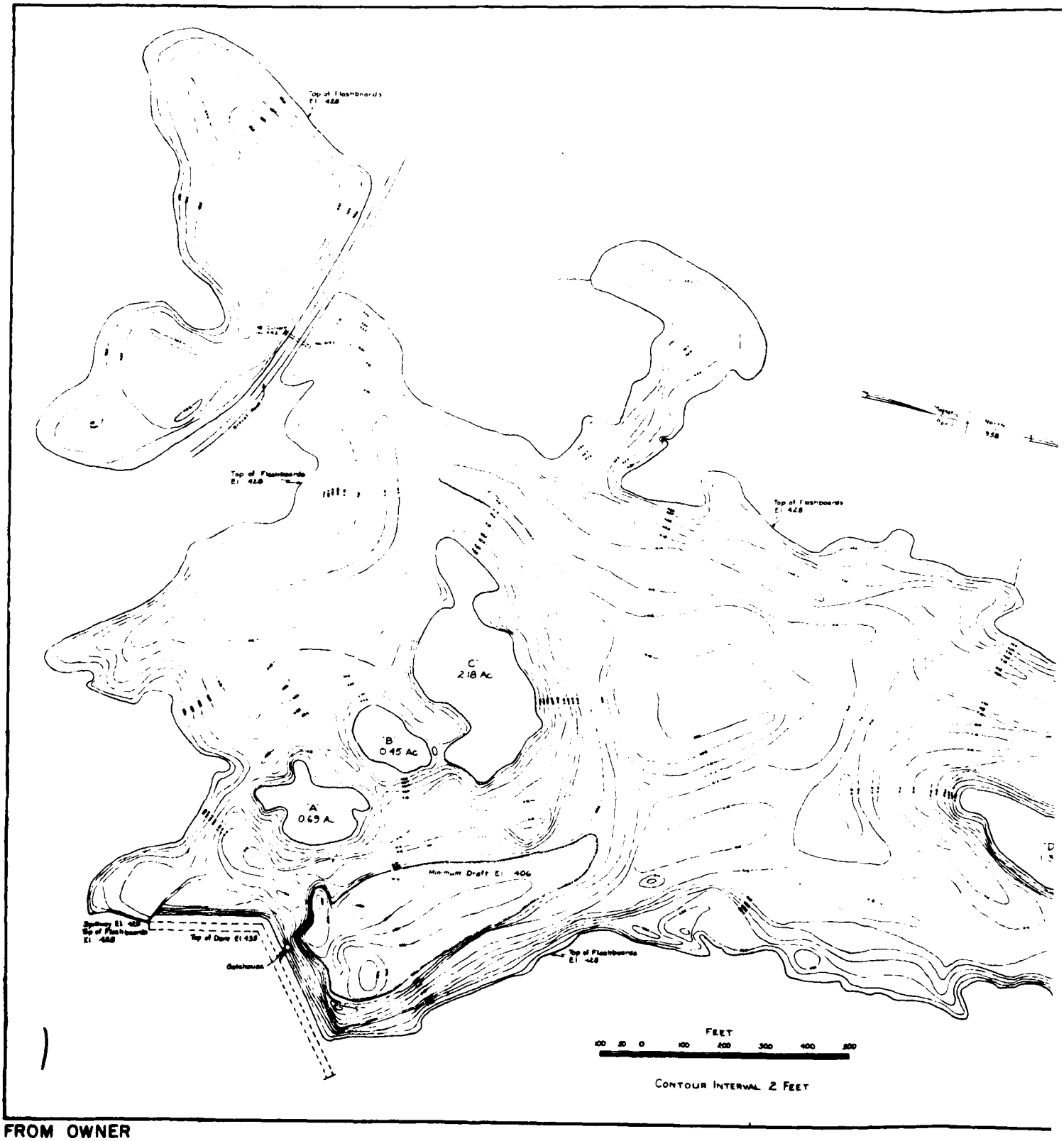
Village of Catskill, New York
POTUCK CREEK SUPPLY
STORAGE CAPACITY CURVE-IMPOUNDING RESERVOIR

Benjamin L. Smith & Associates
Albany, New York

Engineers
July 1958

2

CTM DWG NO. 81-10?



FROM OWNER
REDUCED TO 34% OF ORIGINAL

VILLAGE OF CATSKILL, NEW YORK

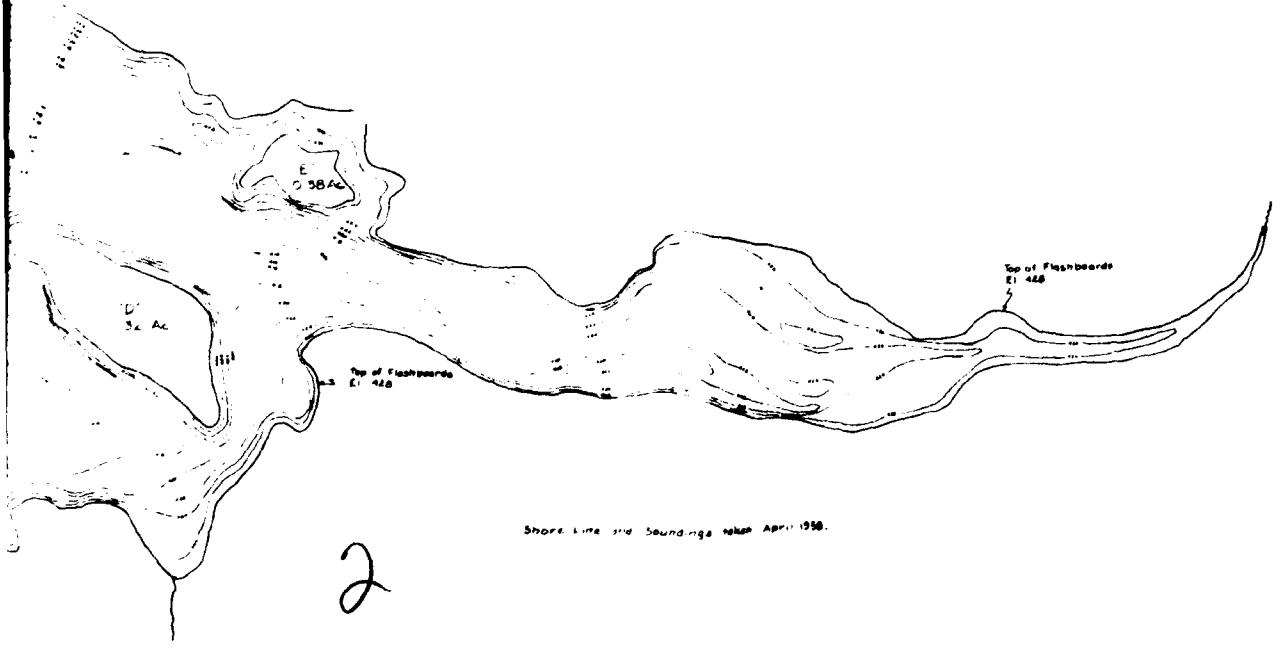
POTUCK CREEK SUPPLY

TOPOGRAPHIC MAP OF IMPOUNDING RESERVOIR

BENJAMIN L. SMITH & ASSOCIATES — CONSULTING ENGINEERS

ALBANY, NEW YORK APRIL 1961

Gross Area of Reservoir at Elev. 428.0	84.29 Acres
Less Area of Islands	5.02
Net Water Surface	79.27 Acres



2

G-8 CTM DWG NO. 81-100

END

DATE
FILMED

11-81

DTIC